

CONGESTION RELIEF ANALYSIS

Vancouver Area Report

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3 Vancouver Urban Area Report

3.0 Summary

This chapter presents the findings for the Vancouver Urban Area (VUA). The scenarios analyzed included strategies on highway, carpooling, transit, and transportation value pricing.¹ The analysis results provide perspectives on how effective these scenarios could be in reducing congestion.

What are the growth challenges in the region?

Growth will continue to pose a challenge to the Vancouver/Portland regional transportation system with additional trips, longer trips and more congestion. The VUA's population grew by more than 153,000 between 1980 and 2000. It is forecast to be slightly less than 540,000 by 2025, a population growth of 63% from existing (2000) conditions. Employment will grow by 68% between 2000 and 2025. Most of this growth is projected to occur in the outlying urban areas of Battle Ground, Ridgefield, La Center, Camas, and Washougal, where little or no fixed-route transit service exists. With marked growth in households, workforce participation, and population, travel demand will significantly increase. Vehicle miles traveled are expected to increase by as much as 70% between 2000 and 2025. By 2025, I-5 and I-205, which serve as the only routes between Vancouver and Portland, are expected to experience a 50% increase over existing condition in terms of the number of vehicle trips. Additionally, travel on other state highways, such as SR 502, SR 503, SR 500, and SR 14 will increase significantly as well.

Table 3-1 Vancouver Projected Growth 2000 to 2025

New Residents	208,500	+63%
New Jobs	107,000	+68%
New Vehicles	174,000	+60%
New Commute Trips	209,000	+67%

Source: Regional Transportation Council, MTP Update

What improvements (scenarios) were modeled?

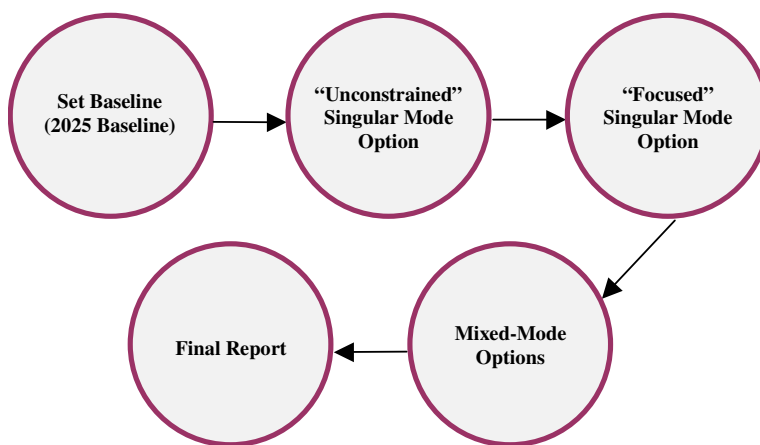
The focus of this study was to evaluate the congestion relief potential of a wide range of modal alternatives. The scenarios were designed to establish incremental "data points" for various combinations of highway, transit, and alternative transportation strategies. The data points were established to discern differences between the level of investment and the results of congestion relief measured by delay reduction.

The scenarios were developed in phases (see Figure 3-1). Two capacity-unconstrained forecasts were developed to provide an analysis reference point, to identify high demand corridors for highway and transit, and to assist in developing the single-mode focused alternatives. Then,

¹ The report summarizes data and results from various transportation scenarios studied during the Urban Areas Congestion Relief Analysis. The report summarizes and presents findings; it is not meant to recommend a specific strategy nor is it intended to replace, update, or propose a specific local, regional or statewide plan, policy or agreement. Information contained in this report should be used and discussed in the context of this study only.

single-mode focused alternatives were developed, using the unconstrained analysis as a guide. They represent a very high level of investment in a single mode, while leaving other modes unimproved. Finally, mixed alternatives were developed with varying investment levels in highways, transit, and demand management or value pricing strategies. The projections of different scenarios are modeled using the Regional Transportation Council (RTC) travel demand model.

Figure 3-1 The Study Process



Reducing highway delay due to congestion was the focus of the study. Transportation analysis metrics and cost-benefit comparisons were used to evaluate alternatives based primarily on their ability to reduce highway congestion. A cursory assessment of their environmental and potential land use impacts was included as well.

For a more direct comparison, the 2025 land use distribution of households and employment was

held constant between alternatives. This has the effect of artificially constraining changes in trip patterns and the location and distribution of land use. In reality, transportation investment decisions do have an impact on land use patterns, and potential impacts to land use are outlined later in the report.

What were the model results?

The scenarios were modeled to answer the following three questions:

How well does each scenario reduce congestion?

What are the costs and economic impacts of each scenario?

What are the potential impacts to the environment for each scenario?

How well does each scenario reduce congestion?

A set of analysis metrics was developed to compare the scenarios. The analysis metrics were a mixture of system-level and corridor-specific measures related to delay for persons, vehicles and trucks, hours of congestion each day, and travel time on major freeway corridors. Compared to the 2025 Baseline Scenario, all scenarios would improve peak period travel times for general purpose, commercial, and transit trips between the key regional activity centers. The regional model predicts that total peak period and daily vehicle delay in the 2025 Baseline Scenario could be 500% more than the 2000 condition. On a per-vehicle basis, many of the scenarios would reduce delay significantly comparing to the 2025 Baseline Scenario, but not below 2000 level. Compounded with more trips and longer trips, total delay on the highway system is forecasted to be higher than that of 2000 even under the most aggressive highway capacity expansion scenario (with an estimated price tag of \$3.2 to \$4.1 billion) analyzed in this study.

Alternatives that include an emphasis on highway widening along with major transit improvements, and those with expanded freeway value pricing and transportation demand management, would be effective in significantly reducing Year 2025 delay compared to baseline. However, total delay at the system level would still double under those alternatives relative to the existing levels. For the scenarios that add only substantial roadway capacity, travel times for vehicles between activity centers in year 2025 would be comparable to today's conditions (2000). Scenarios that have significant investment in exclusive-guideway, high capacity transit (HCT), and/or expanded express bus service would also yield travel time savings to transit patrons.

Comparing the model results among the scenarios, the following observations were made:

- The 2025 Baseline Scenario estimated that total daily delay for vehicles on the region's roadway system would have a 500% increase over 2000.
- Most of the freeway corridors, especially I-5 and I-205, would require additional lanes to accommodate all highway demand in the peak period. For example, the number of freeway lanes crossing the Columbia River would need to more than double to reduce 2025 congestion below the year 2000 level.
- Transit ridership would triple if a transit system that featured frequent bus service with high and reliable speeds, and if everyone had direct access to transit throughout the region was available.
- Pricing of the full freeway system was very effective in reducing congestion and improving travel times assuming that alternative travel options could be provided for trips diverted from highways.
- Travel delay would be reduced substantially in the corridors where capacity improvements were tested. However, all the scenarios that exclude value pricing strategies did not produce positive annual benefits.
- Mode share for transit trips between Clark County and Oregon would increase by 30-35% for the scenarios with a high level of transit investment. This mode share could be even higher if high transit investment is combined with value pricing or transportation demand management strategies.
- Highway investments tended to generate more congestion benefits per dollar of investment than did the transit investments. However, transit investments tended to generate higher benefits per transit trip than highway investments did per highway trip.
- Transit-oriented scenarios were effective in improving transit travel times. Transit was most effective in the corridors where there were high population and employment densities and where there are limited potential to add additional roadway capacity.
- Adding value pricing strategies to a scenario with a mix of highway and transit capacity improvements produced a large increase in benefits with a relatively small additional cost. The new scenario with a mixed highway and transit improvements plus value pricing resulted in a more efficient use of the available capacity within the system. Value pricing resulted in changes of travel behavior, including shifts to different modes, different routes, and different times of the day, which helped to reduce delay.

What are the estimated costs of each scenario?

Most of the scenarios analyzed would cost over \$5 billion for the Vancouver/Portland study area. The Highway Focus and mixed-mode Highway & Transit Intensive scenarios have the highest capital costs, on the order of \$10 to 13 billion. A significant portion of these costs would be incurred in the dense urban cores of Portland and Vancouver. Alternatives with major transit improvements have the highest annual operating and maintenance costs.

All scenarios except the Pricing Focus Scenarios would have substantial right-of-way needs and property impacts. In most cases there are insufficient existing rights-of-way to accommodate both highway widening and high capacity transit. The Transit Focus Scenario has a moderate level of right-of-way acquisition. The greatest impacts are associated with significant roadway only-related improvements or a combination of highway widening and high capacity transit facilities.

Operations and maintenance (O&M) costs are generally much higher for transit-oriented scenarios than for highway-oriented scenarios. The scenarios with value pricing, especially the Pricing Focus Scenario, would also have relatively high O&M costs because of ongoing operation, administration, and enforcement activities associated with system wide tolling. A portion of revenues collected from tolls could be used to offset these costs.

The ability to fund the various improvements was not considered. It is conceivable that potential funding mechanisms for investments measured in the billions of dollars – such as a substantial increase in the gas tax – may affect travel behavior, and thus the mix of supply and demand measures required to mitigate congestion delays. The scenarios with value pricing were assumed to generate revenues sufficient to offset costs, although this study has not presumed how those revenues might be spent.

What are the potential impacts to the environment for each scenario?

The purpose of the environmental review was to identify the primary environmental factors contributing to the costs of each scenario, as well as the major areas where environmental impacts could be anticipated. The Congestion Relief Analysis focused on environmental impacts at the system-wide level for each scenario.

The following observations can be made:

- Most scenarios would involve substantial right-of-way and property acquisition, and yield impacts on wetlands and streams. The greatest impacts would be associated with highway widening improvements.
- Alternatives that have a transit emphasis tend to have fewer impacts on the built and natural environments, compared to alternatives that have a highway widening emphasis. Transit emphasis would also have fewer air- and noise-quality, and Environmental Justice issues.
- Air quality impacts are primarily associated with highway improvements. Transit improvements and value pricing strategies are anticipated to reduce vehicle trips and vehicle miles traveled, and therefore reduce air pollutant emissions. Air pollutant emissions would be lowest under the value pricing scenarios.
- Noise levels are expected to be highest with the highway-oriented scenarios. Transit noise levels are expected to be low, while pricing scenarios would have the effect of moving traffic (and noise) from one facility to another.

- Impacts on low-income and/or minority communities (Environmental Justice issues) were analyzed using 2000 Census maps for Portland and Vancouver. The results showed that these communities would experience both negative impacts and positive benefits. On the one hand, the communities may experience direct negative impacts such as relocation and increases in noise and air pollutants, primarily associated with the highway-oriented scenarios. On the other hand, these communities and residents in other communities will benefit from the provision of additional transportation capacity under all scenarios, especially with added transit access and service under the transit-oriented scenarios. Corridors that have the highest potential for Environmental Justice impacts are I-5 in north Portland and central Vancouver and I-205 in east Portland and between SR 14 and SR 500 in Vancouver.
- The effects of value pricing on low-income and/or minority communities would depend on the toll rates set, the allocation of toll revenues, and the availability of transit or other alternative modes that may have a lower direct-cost to the users. Projects implemented to date elsewhere show that priced lanes are used by a broad cross-section of income and population groups.
- Significant highway capacity expansion would have major impacts on land use and development patterns, increasing pressure to expand the urban growth boundary.

3.1 Study Area Definition

The study area (Figure 3-2) includes the Vancouver Urban Area (VUA), a portion of northeast of Portland, the Portland Central Business District, and the I-5/I-405 loop around the Portland CBD. The VUA contains the area south of NE 219th Street to the Columbia River, bounded on the east by the 192nd Avenue corridor and on the west by the Columbia River. The portion of northeast of Portland covers I-5 to I-205, from I-84 north to the Columbia River. Significant trip interactions between Vancouver and Portland are the main reason to include part of Portland in the study area.

3.2 Major Corridors

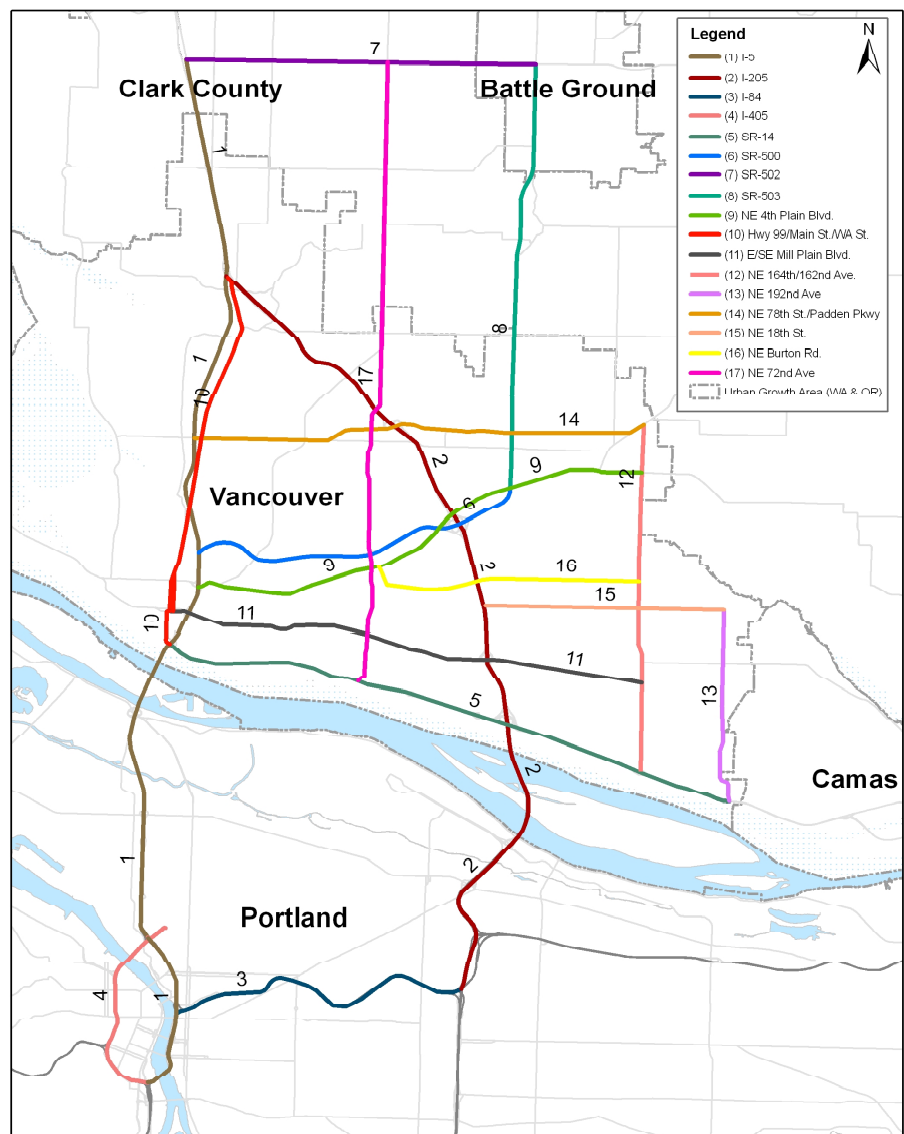
Study corridors consist of all state highways and interstate facilities in the study area, and some key regional arterials. Study corridors are shown in Figure 3-2.

Improvements to other regional arterials were also included in the transportation modeling and results, but were not included in the assessment of cost, and environmental and economic impacts.

These corridors were:

- Fourth Plain Boulevard, I-5 to SR 500
- Burton Road/28th Street, Andresen Road to NE 162nd Avenue
- NE 18th Street, NE 86th Avenue to NE 192nd Avenue
- Highway 99/Main Street, NE 134th Street to downtown Vancouver
- Andresen Road, Padden Parkway to SR 14

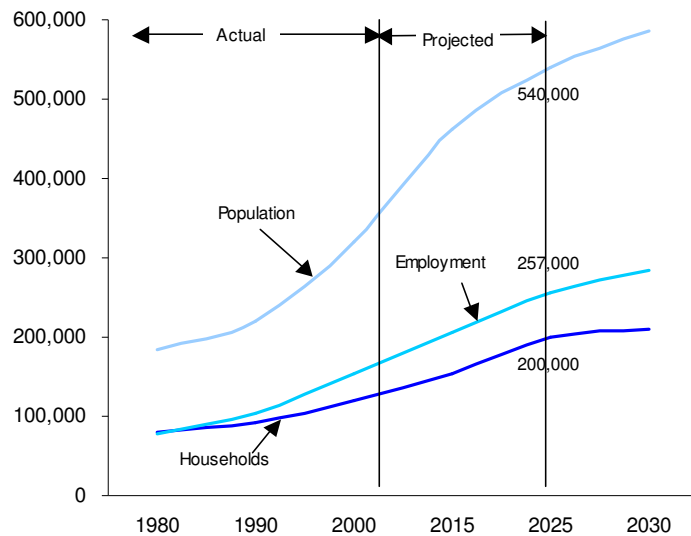
Figure 3-2: Study Area and Corridors



3.3 Historical, Existing, and Future Population and Employment Patterns

The Vancouver Urban Area's population grew by more than 153,000 between 1980 and 2000 and is forecast to be about 540,000 by 2025. This marks a population growth of 63% increase from existing (2000) conditions. It is also projected that full- and part-time employment will grow by 69% between 2000 and 2025. Much of this growth is projected to occur in the outlying urban areas of Battle Ground, Ridgefield, La Center, Camas, and Washougal. The growth in Vancouver area households, population, and employment is shown in Figure 3-3.

Figure 3-3 Vancouver Area Growth in Households, Population, and Employment



Source: Regional Transportation Council and Clark County

Table 3-2 Households, Population, and Employment 1980 to 2030

	1980	1990	2000	2015	2025	2030
Households	68,000	90,000	130,000	168,000	200,000	214,000
Population	180,200	235,000	331,500	463,000	540,000	586,900
Employment	67,000	100,000	158,000	210,000	265,000	286,400

Source: Regional Transportation Council and Clark County

3.4 Existing and Future Travel

With marked growth in households, workforce participation, and population from 2000 to 2025, travel demand will significantly increase. Daily vehicle trips, transit trips, and total vehicle miles are expected to increase 61-63% between 2000 and 2025.

The average trip travel distance would increase 2-17% in the study area during the same period. However, if only current and granted transportation improvement projects are counted, the lane miles and daily transit service will increase only 11% and 1% respectively from 2000 to 2025.

Figure 3-4 shows the increases of vehicle trips and VMT, and lane miles and transit service between 2000 and 2025.

The comparison suggests that travel demand in the near future (2025) will exceed transportation system capacity. As a result, total daily vehicle hours of delay are forecasted to have over a 500% increase between 2000 and 2025, and daily vehicle hours of delay are expected to have a 400% increase as well. Accordingly, the average trip time within the study area would increase 13-33%. Transit mode share in the study area would decrease 3-10% from 2000 to 2025. Table 3-3 provides a summary of the VUA system of travel forecasts.

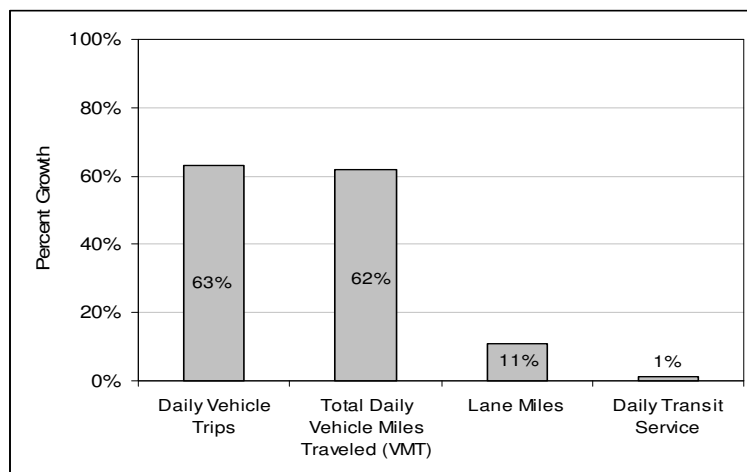
Growth Exceeds Capacity

Growth in trips and vehicle miles traveled will greatly exceed additional capacity in the 2025 Baseline Scenario

Table 3-3 System-Wide Summary of Travel Forecasts

	2000 Existing	2025 Baseline	Change 2000 – 2025
Daily Total Person Trips	1,426,000	2,295,000	61%
Daily Total Vehicle Trips	1,010,000	1,648,000	63%
Daily Transit Trips	28,000	45,000	61%
Total Daily Vehicle Miles Travel (VMT)	6,807,000	11,026,000	62%
Study Corridor Lane Miles	882	976	11%
Daily Transit Service Hours	900	912	1%
Average Trip Length within Clark County (miles)	5.1	5.2	2%
Average Trip Length, Clark County to Portland (miles)	18.2	21.3	17%
Average Trip Length, within Clark County (minutes)	8.9	10.1	13%
Average Trip Length, Clark County to Portland (minutes)	28.8	38.1	33%
Transit Mode Share, Within Clark County	1.0%	0.9%	-10%
Transit Mode Share, Clark County to Portland	5.8%	5.7%	-3%
Total Daily Vehicle Hours of Delay	7,235	43,662	503%
Daily Commercial Vehicle Hours of Delay	217	1,085	400%

Figure 3-4 Change from 2000 to 2025, Percent Increase in Number of Trips, Vehicle Miles Traveled (VMT), Lane Miles and Transit Service



3.5 Scenario Configurations

Eight transportation scenarios were developed for the Vancouver region. The scenarios were then modeled to see how effective they would be in reducing congestion, and at what cost. The modeling began with existing conditions (year 2000) and a 2025 Baseline Scenario that only includes projects with current funding commitments. Three additional scenarios followed that focused exclusively on roadways, transit, or value pricing. Three scenarios followed these that included investments in more than one mode or type of capacity improvement. Finally, additional analysis was undertaken on the Transit Emphasis Mixed Scenario to examine the potential congestion-reduction effects of freeway value pricing, and of an expanded transportation demand management program.

Existing and Baseline models

The year 2000 is considered as the model's "Existing year." The 2000 Census was used to estimate the number of people and households by TAZ, and employment was estimated from a variety of sources. The model was calibrated and validated based on a comprehensive set of traffic counts and transit ridership counts taken during 2000 and 2001.

The 2025 Baseline scenario is the existing plus financially committed projects contained in the current Metropolitan Transportation Improvement Programs for both RTC and Metro. It does not include other projects that may be in the financially-constrained Metropolitan/Region Transportation Plans that are not programmed in currently adopted TIPs.

Existing Condition (2000)

The existing condition is the transportation system as defined in the regional model base year model, the year 2000. Figures 3-5 and 3-6 show the number of general-purpose lanes included in the existing highway network, and the existing transit service, respectively.

In this study, key congestion measures are delay, and congestion duration. "Delay" is the additional travel time incurred when speeds in any roadway segment in the alternative being modeled fall below the average speed for the same roadway section when that section is operating at 70% of capacity. "Congestion duration", generally measured in hours, is the time period that the corridor volume exceeds the corridor capacity by travel directions.

Figure 3-5: Existing Highway Network

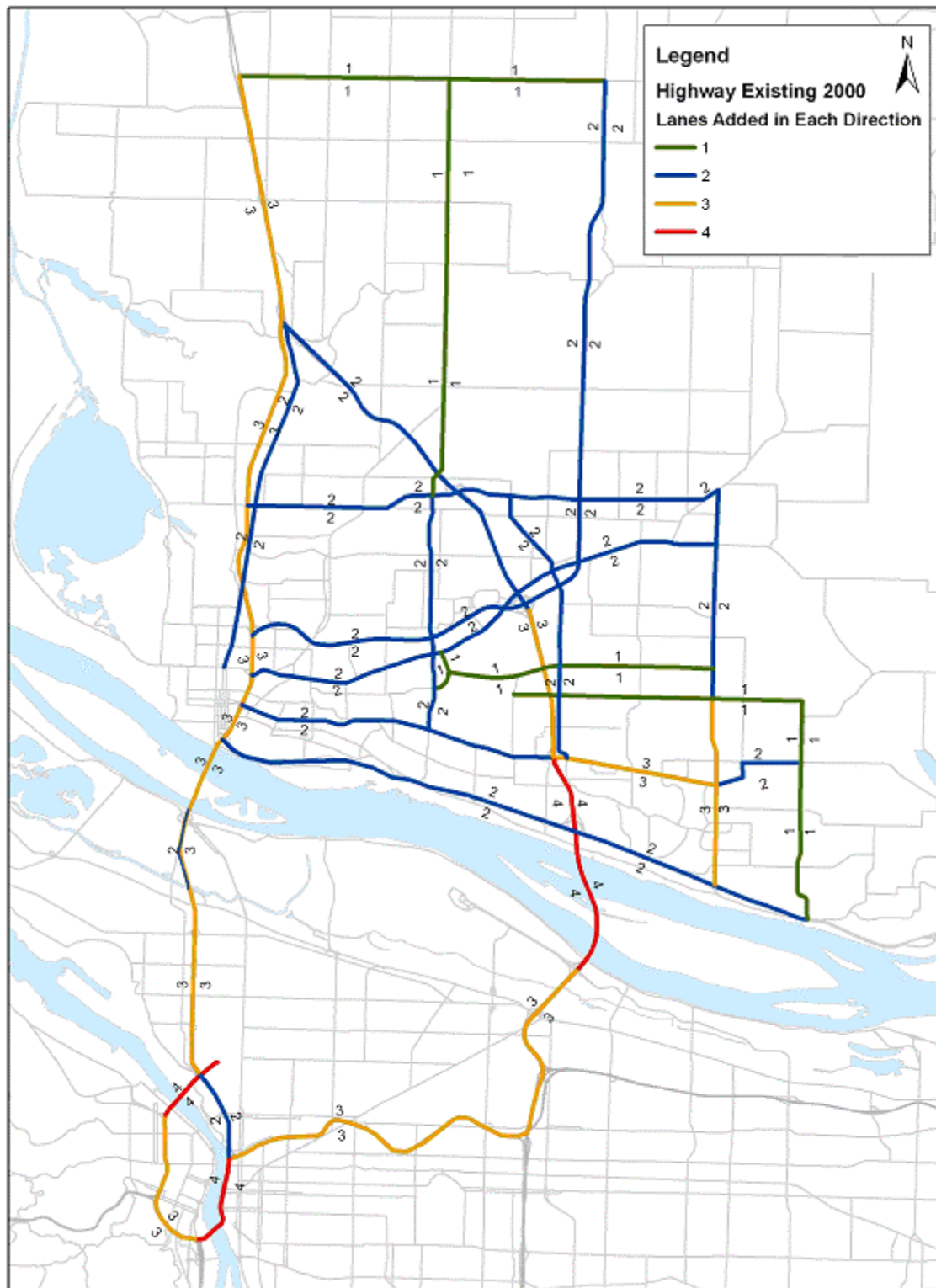


Figure 3-6 Existing Transit Network



2025 Baseline Scenario

The 2025 Baseline Scenario provides a reference frame for examining the various congestion relief scenarios. The 2025 Baseline Scenario is defined as the existing highway and transit networks, plus improvements currently funded and programmed as identified by WSDOT, C-TRAN, Tri-Met, ODOT, Metro, and RTC.

The 2025 Baseline Scenario reflects an increase in 10% of highway lane miles over the 2000 conditions. Transit service is expected to increase slightly above existing conditions, with approximately 1.3% additional service hours. Figures 3-8, 3-9 and 3-10 show the roadway and transit improvements, included in the 2025 Baseline Scenario. A few major improvement projects were added to the 2000 network. These improvements are shown in Table 3-4.

Table 3-4 Projects Completed Since 2000 and Projects with Funding Commitments

Projects Completed Since 2000	
Portland	• Completion of Interstate MAX light rail line
Clark County	• Widening of I-5 from SR 500 to 99 th Street
	• Completion of Padden Parkway
Projects With Funding Commitments	
Portland	• I-205 light rail from Gateway to Clackamas
	• Widening of I-5 through Delta Park
Clark County	• Widening of I-5 from 99 th Street to 134 th Street
	• C-TRAN's 99 th Street Park-and-Ride
	• Completion of 192 nd Avenue corridor
	• Widening of 162 nd Avenue from 39 th Street to Ward Road to four lanes

Figure 3-7 shows the Existing and 2025 Baseline networks and durations of congestion. These are from the RTC's Year 2000 PM peak period model run. Under the 2025 Baseline Scenario, congestion levels would continue to grow in all study corridors and all Interstate highways. The highest congestion levels would be experienced on the I-5 and I-205 Columbia River crossings and on all of I-84 (up to 5 hours of congestion per direction per day).

Other corridors experiencing significantly increased congestion would include the I-5/I-405 "downtown loop," SR 500/ SR 503 between I-5 through Orchards and north to Battle Ground, SR 502 from I-5 to Battle Ground, and I-5 from SR 502 to the I-5/I-205 split.

Figure 3-7 Lanes Added to Existing in the 2025 Baseline Highway Network

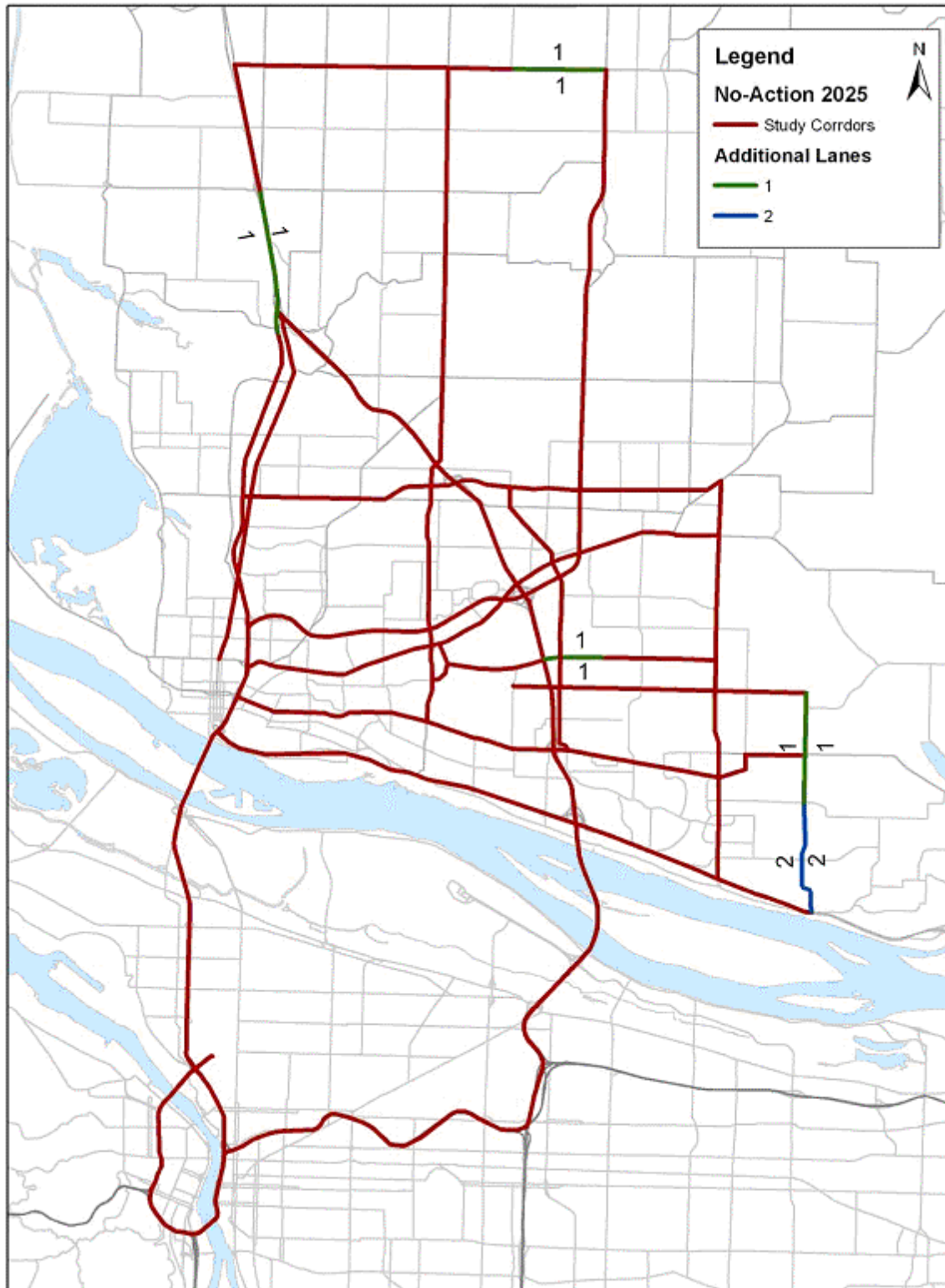


Figure 3-8: Transit Network in the 2025 Baseline Scenario

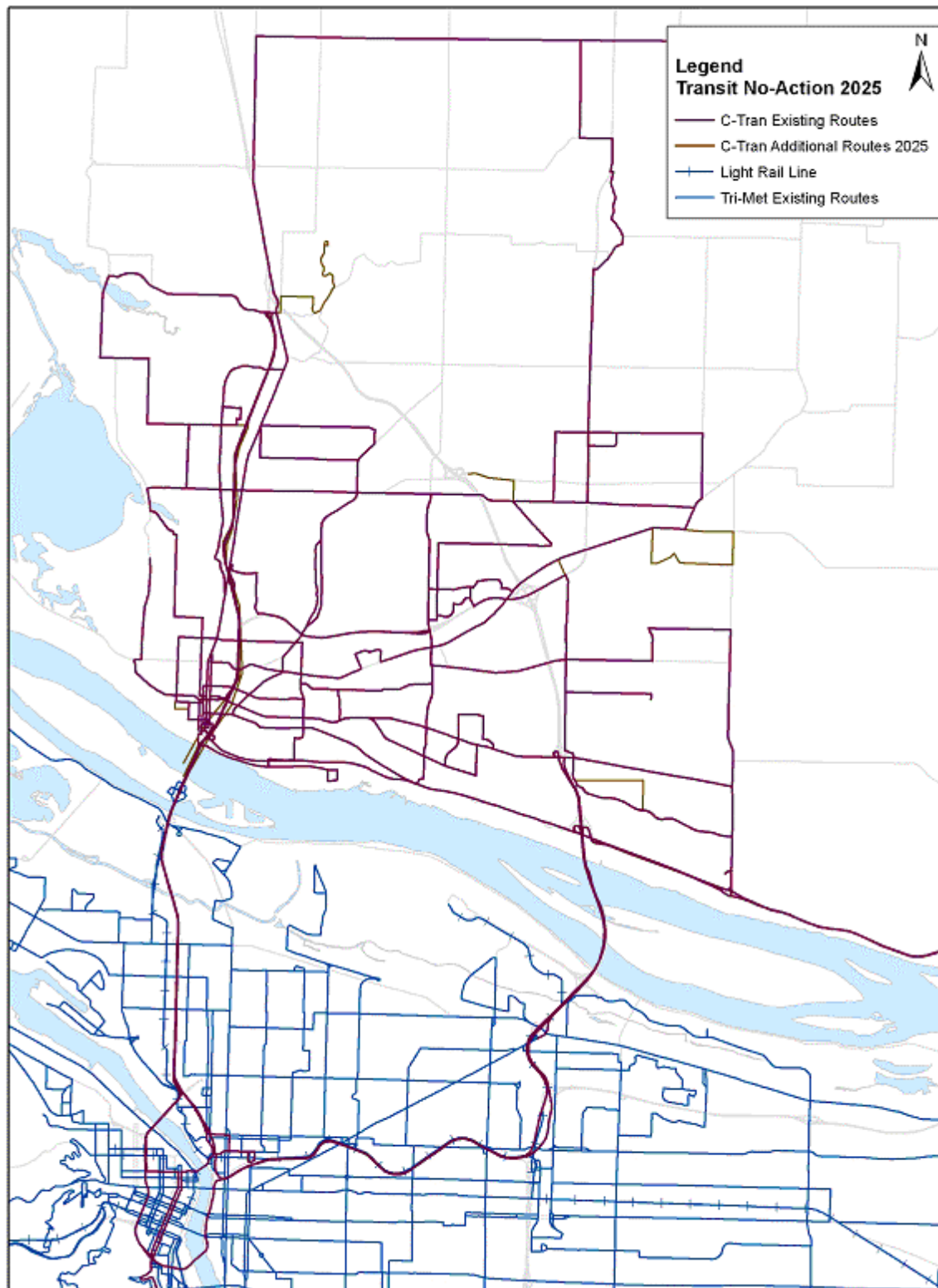
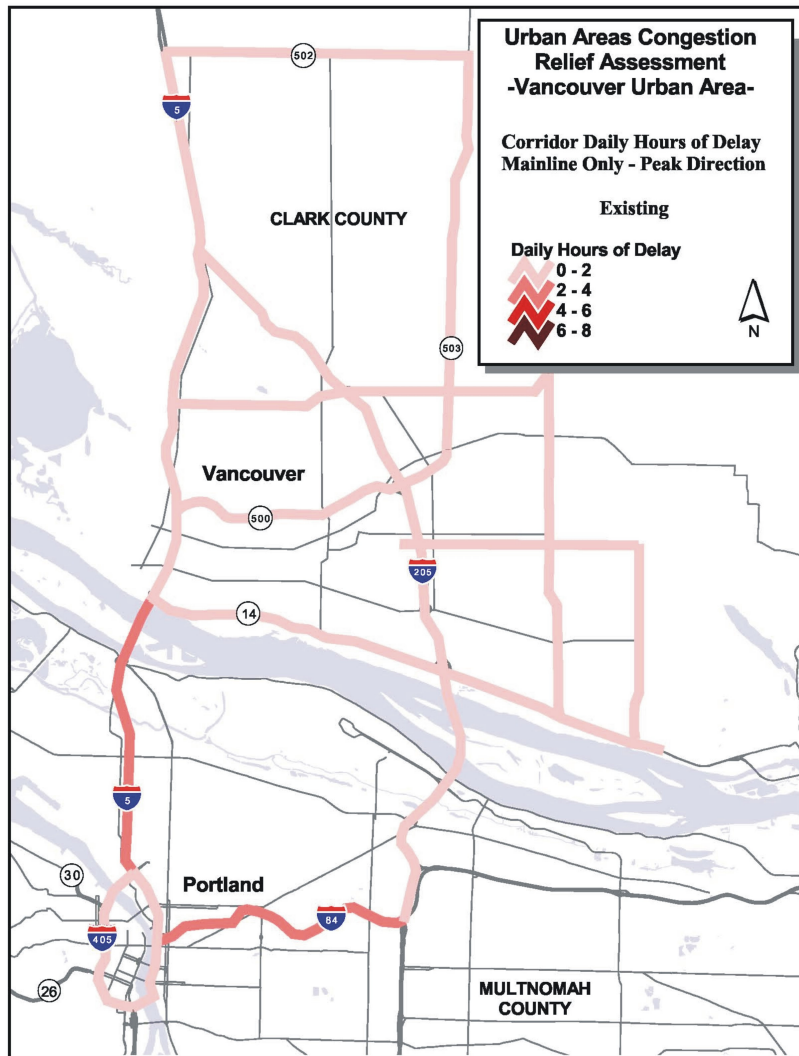
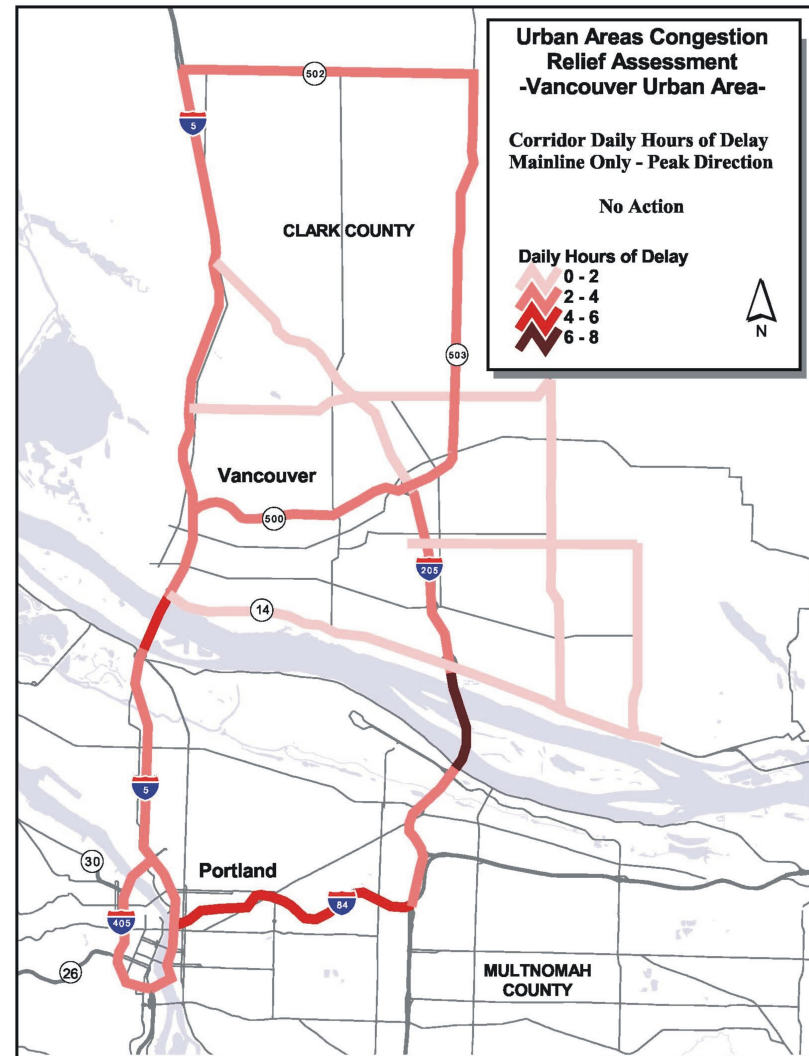


Figure 3-9: Daily Hours of Congestion

The Existing Condition



The 2025 Baseline Condition



Unconstrained Demand Scenarios

In order to help frame the scenarios, two capacity-unconstrained forecasts were developed: the Unconstrained Highway Scenario assumed no congestion would occur given additional highway facilities to accommodate all travel demand, and the Unconstrained Transit Scenario assumed a virtually ubiquitous system whereby all trips had access to transit. The unconstrained forecasts were used to identify the highest travel demand corridors during peak period.

Unconstrained Highway Demand Analysis

The intent of the Unconstrained Highway Demand Analysis was to determine theoretical vehicle travel demand if there was no capacity constraints; all travelers could travel at any time throughout the region and experience no highway congestion. Figure 3-10 shows the unconstrained demand and desired routes in the Vancouver/Portland region. The map on the left shows the large increase in the vehicle trips that would take place on the major freeways, state highways, and principal arterial routes. On the regional freeway system, the volumes would essentially double the existing volumes while volumes on low speed, minor arterials would decrease (map on the right). Using the information shown in Figure 3-10, the unconstrained highway demand was then translated into an equivalent number of additional highway lanes that would be needed to serve all the peak demand. As shown in Figure 3-11, most freeway corridors would require several additional lanes to carry out the 'unconstrained demand'. Conversely, volumes on most local arterial routes would decrease if capacity were focused on the major state highways.

As an example, the following additional lanes (two directions combined) would be required to meet this demand:

I-5 and I-205 Columbia River Crossings: 10-12 new lanes

SR 500, I-5 to I-205: 2-4 new lanes

SR 503, SR 500 to Battle Ground: 3-6 new lanes

SR 502, I-5 to Battle Ground: 2-4 new lanes

I-5, SR 500 to I-205: 3-6 new lanes

Mill Plain Boulevard, I-205 to SE 164th Avenue: 2-4 new lanes

These results were used to help shape the Highway Focus Scenario and to compare certain key performance data.

Figure 3-10: Changes in Daily Vehicle Volumes in the Unconstrained Highway Demand Analysis (vs. 2025 Baseline)

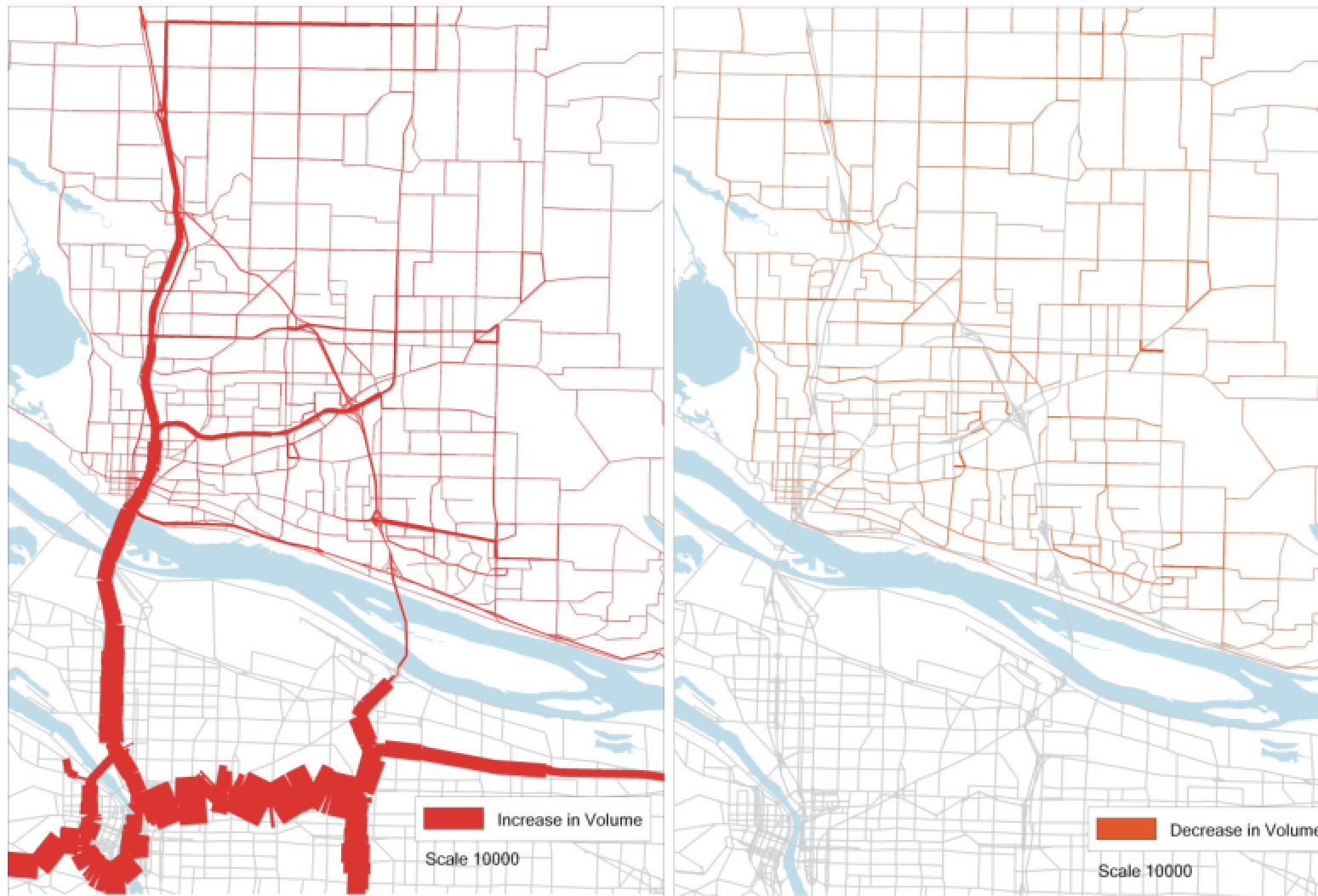
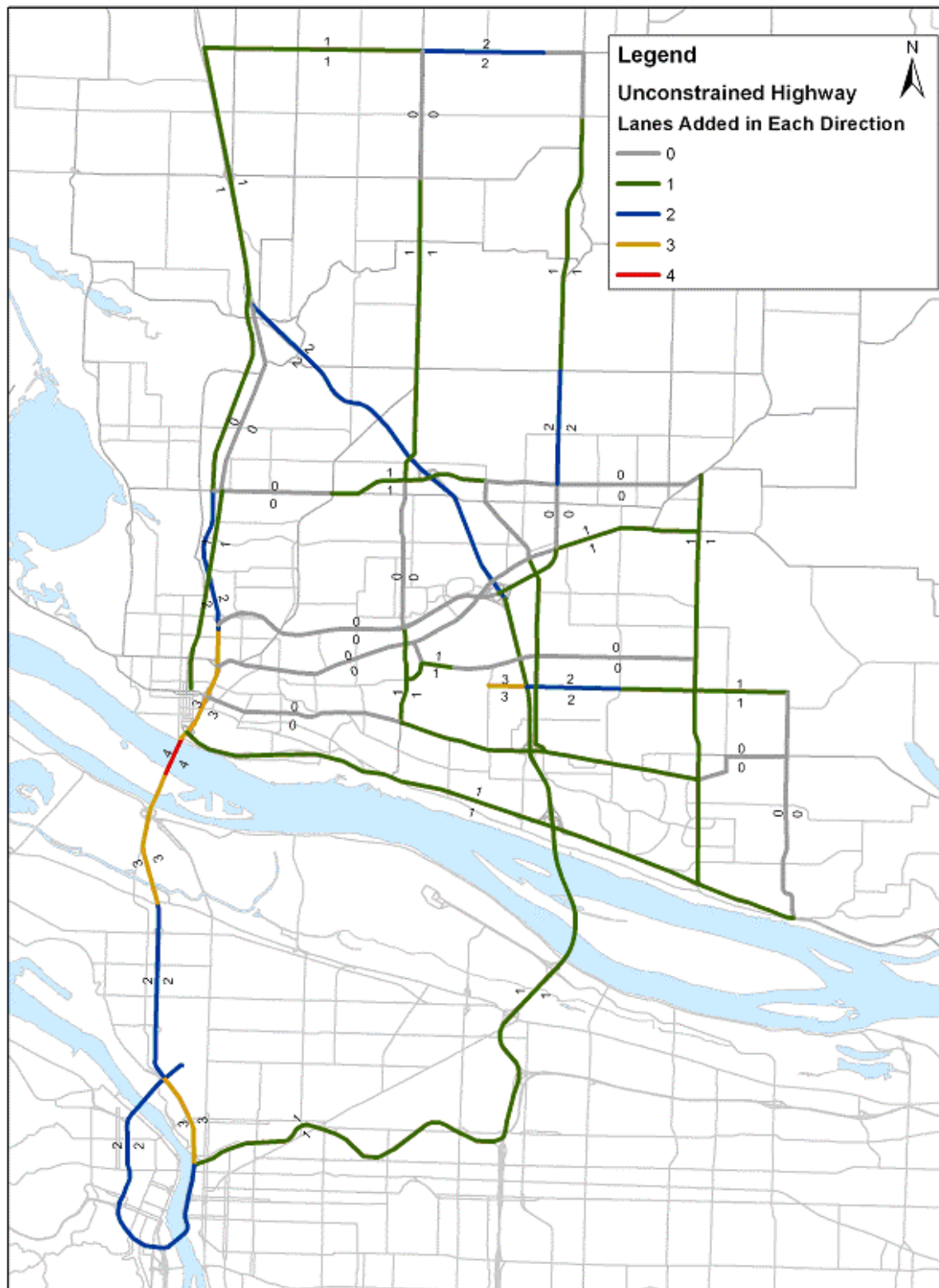


Figure 3-11: Additional Lanes Needed to Satisfy Unconstrained Highway Demand



Unconstrained Transit Demand Analysis

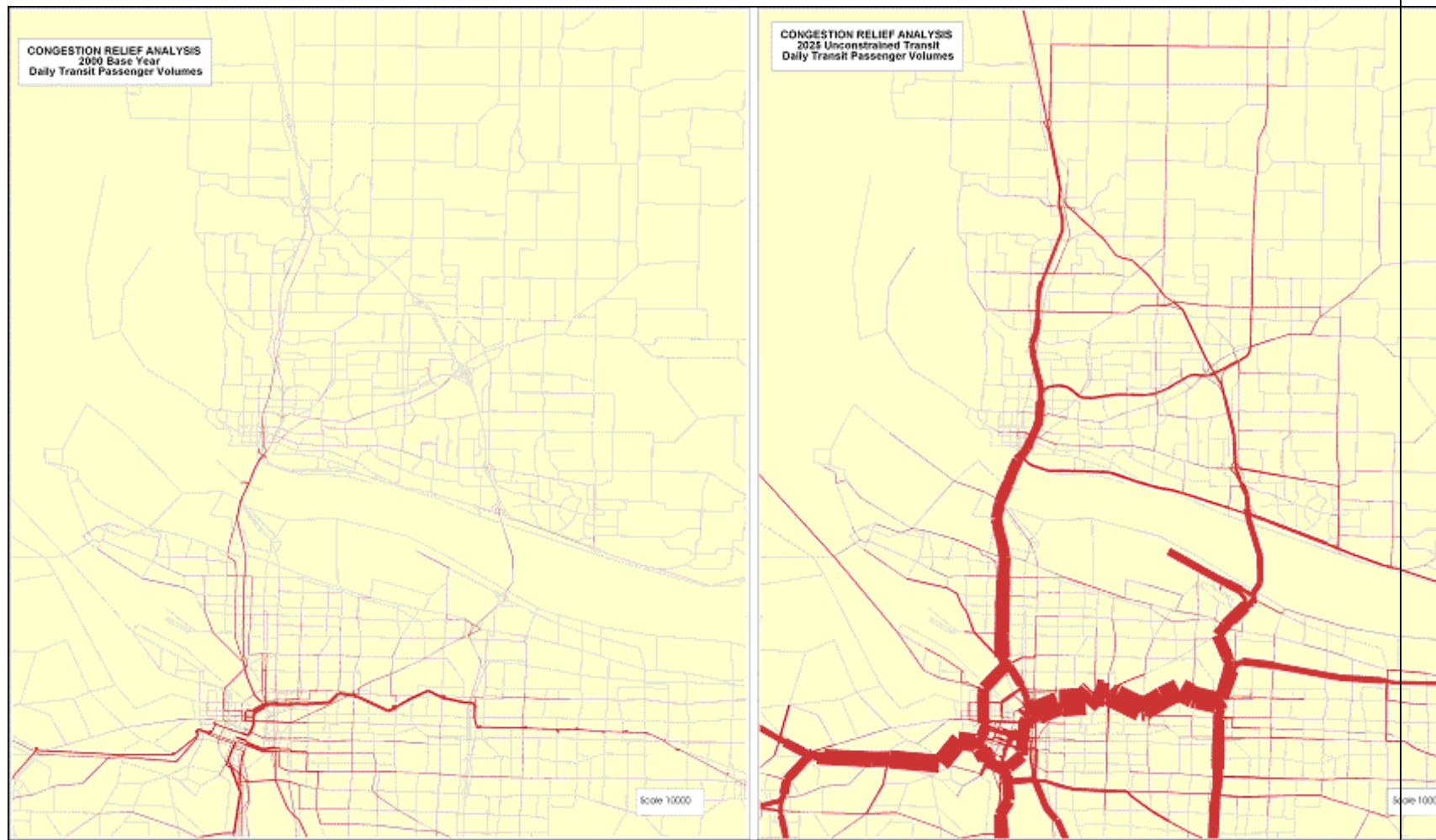
The Unconstrained Transit Demand Analysis assumed everyone has direct walk access to transit (within 2.5 minutes) that connects every destination within the region with wait times of 5 minutes in the peak and 7.5 minutes off peak. The transit speed was assumed to be a constant 18 mph for all trips (12-14 mph is today's average). A "fare-free" system region-wide was also assumed for the transit system.

Figure 3-12 shows the results of the unconstrained transit ridership forecasts within the region, compared with existing transit ridership. This ubiquitous transit system would result in an increase in daily ridership in the Vancouver region from approximately 20,000 today to as high as 58,000 in 2025 (almost a tripling).

Using this information, the study team identified corridors with the highest transit demand as possible high capacity transit (HCT) routes, while other corridors were identified as candidates for expanded bus service. These results were used to help shape the Transit Focus Scenario and the mixed scenarios.

Even with this ubiquitous transit system, the model shows that highway travel would continue to increase. Figure 3-13 compares daily vehicle travel on the network today with the amount of vehicle trips in 2025 (with the Unconstrained Transit Demand Analysis). There would be enough demand on the highway to cause almost 35,800 hours of delay per day compared to 7,200 today. This is 28,000 hours per day more than today's estimated delay.

Figure 3-12: Comparison of Ridership for Existing & Unconstrained Transit Demand

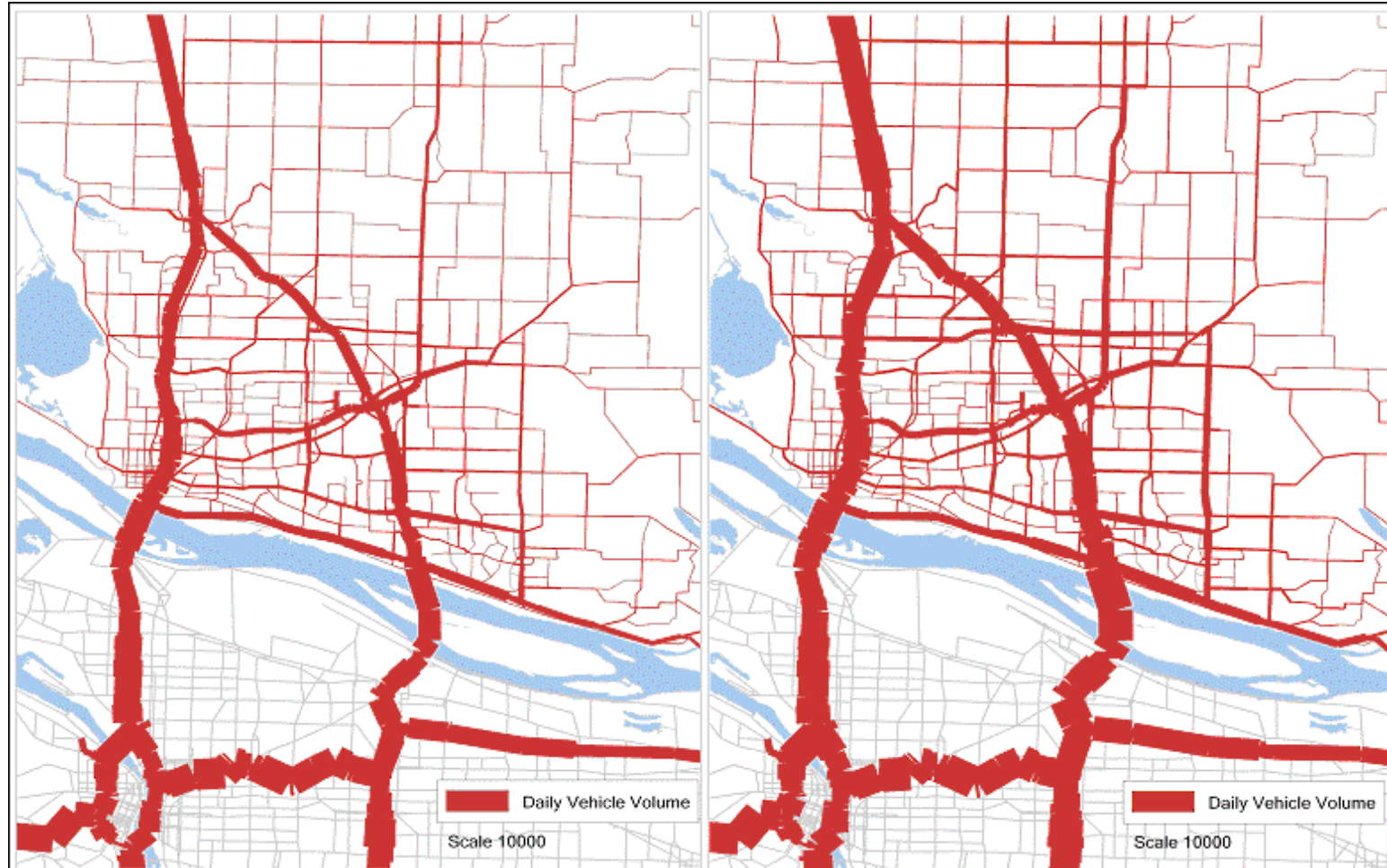


What happens to transit demand?

Today there are 20,000 daily transit riders in the Vancouver region

In 2025, an unconstrained transit system would attract three times as many riders (up to 58,000 per day)

Figure 3-13: Comparison of Vehicle Volumes for Existing & Unconstrained Transit Demand



What happens to hours of delay?

Currently, 930,000 daily vehicle trips result in over 7,200 hours of daily delay. With no improvements to the system, the 1.5 million vehicle trips per day in the 2025 Baseline will result in over 43,600 vehicle hours of daily delay.

Even with an unconstrained transit system, there will be 28,000 additional vehicle hours of daily delay in 2025. Even with the intensive highway improvements contained in the Highway Focus Scenario, there will still be an increase of over 5,600 vehicle hours of delay compared to existing conditions.

Highway Focus Scenario

The Highway Focus Scenario provided highway capacity intended to meet much of the travel demand. Specific capacity improvements that were identified based on the results of the 2025 Baseline and Unconstrained Highway Demand and the future highway projects identified in RTC's Metropolitan Transportation Plan (MTP) were included in the Highway Focus Scenario. The Highway Focus Scenario was to examine whether congestion could be alleviated through aggressive road-building programs.

In the Vancouver region, the Highway Focus Scenario would provide 100 more freeway lane miles and over 180 more arterial lane miles than that of the 2025 Baseline Scenario. Table 3-5 shows the specific corridor segments and the total number of additional lanes in the Highway Focus Scenario. Figure 3-14 shows the number of the lanes required above the baseline in the Highway Focus Scenario.

Following are some specific locations where additional lanes were modeled:

- I-5 and I-205 through Portland and Vancouver
- Both Columbia River Crossings (added six to eight lanes to I-5 and two lanes to I-205)
- SR 503 from Vancouver to Battle Ground
- SR 14 from Vancouver to Camas
- SR 502 from I-5 to Battle Ground
- I-84 from downtown Portland to I-205 (added a lane in each direction)

Table 3-5 Number of Lanes in Highway Focus Scenario²

Corridor	Segment	Total Number of Lanes (Both Directions)	Number of Lanes Above Baseline
I-405	Fremont to Marquam Bridges ³	12	4
I-5	I-405 to Columbia Blvd.	10	4
I-5	Columbia Blvd. to SR 500	12-14	6-8
I-5	SR 500 to 78 th Street	10	4
I-5	78 th Street to I-205	8	2
I-84	I-5 to I-205	8	2
I-205	I-84 to Airport Way	8	2
I-205	Airport Way to Mill Plain	10	2
I-205	Mill Plain to SR 500	8	2
I-205	SR 500 to I-5	6	2
SR 500	I-205 to SR 503	8	2
SR 502	NE 72 nd Ave. to Battle Ground	6	2
SR 503	SR 500 to 99 th Street	8	4
SR 503	99 th Street to SR 502	6	2
SR 14	I-5 to SE 192 nd Avenue	6	2
162 nd /164 th Avenue	SR 14 to Ward Road	6-8	2

² Listed only for those that had an increased number of lanes compared to Baseline.

³ Capital costs assume a tunnel for this segment.

Figure 3-14: Number of Additional Highway Lanes in the Highway Focus Scenario



Transit Focus Scenario

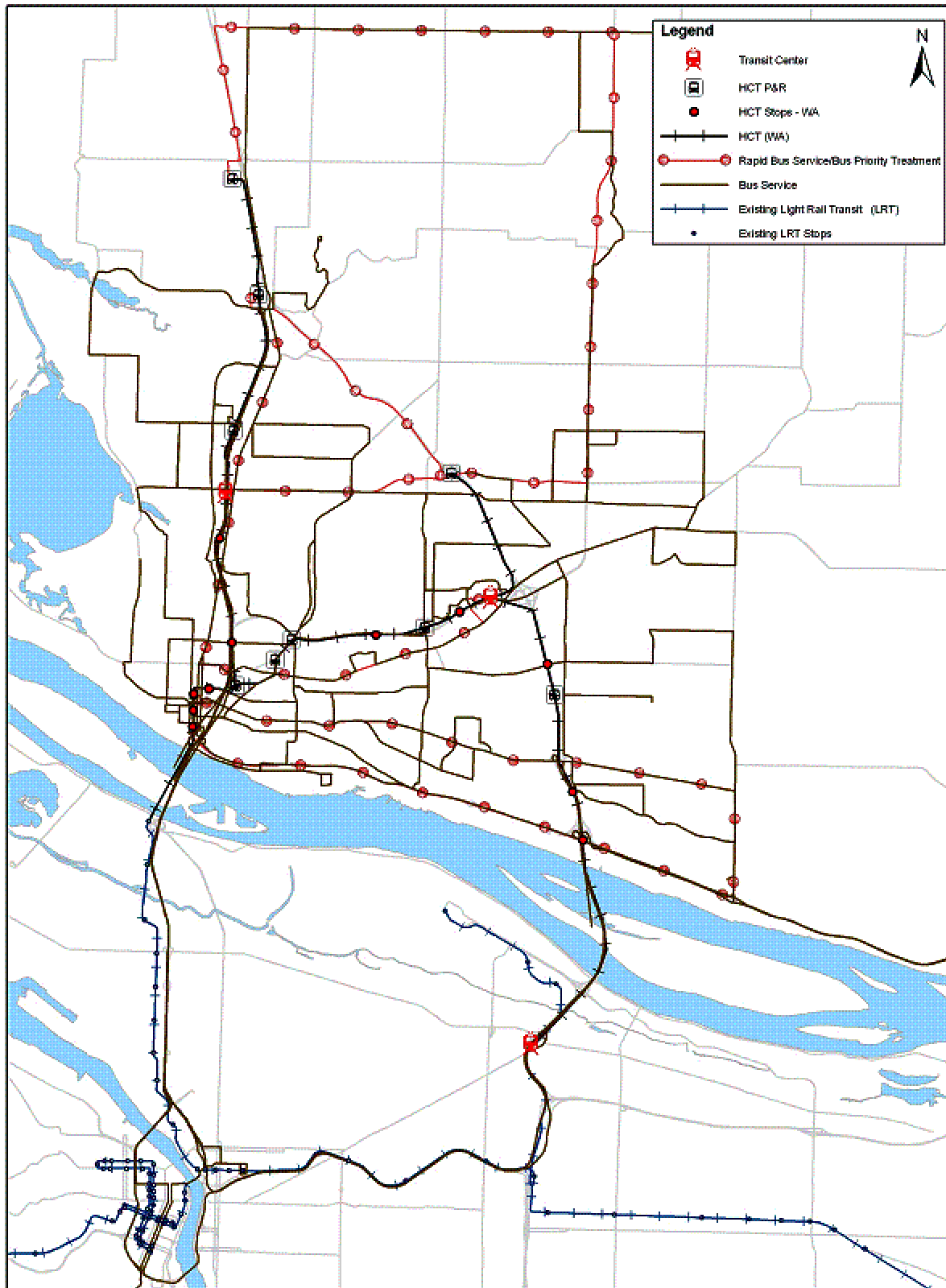
The Transit Focus Scenario included an extensive regional transit system responding to the major travel corridors identified from the transit-unconstrained demand forecasts. The details of this scenario were developed in coordination with WSDOT, RTC, C-TRAN, and Tri-Met. The HCT lines were assumed to operate all day, in both directions with 10-minute peak headways. The Transit Focus Scenario was to examine effectiveness of transit strategies on reducing congestion.

The Transit Focus Scenario extended high capacity transit (HCT) into Clark County and provided for “rapid bus” service on major corridors within Clark County. Bus priority type treatment and a fixed route bus service were included in selected corridors. Three new HCT services were tested:

- The Yellow Line on I-5 north to the Clark County Fairgrounds (NE 179th Street);
- The Green Line which extended from Central County Park-and-Ride at the Padden Parkway and followed I-205 south across the Columbia River, tying into the existing Red Line (Airport MAX) at either the Cascades or the Parkrose MAX station, and
- The “Plaid Line” which extended from Central County Park-and-Ride at I-205 and the Padden Parkway south to Vancouver Mall, and then west on SR 500 to St. Johns Road where it then turned southwesterly into downtown Vancouver and then intersected the I-5 Yellow Line near the Veterans’ Association Hospital.

HCT stations and Park-and-Rides, and transit centers along the HCT routes are shown in Figure 3-15. Intelligent Transportation Systems/bus-priority type treatment (Limited Stop Routes) would be provided along sections of SR 14, 164th Ave., Mill Plain, 4th Plain, Padden Parkway, SR 503, SR 502, and Highway 99/Main St. The frequency for these bus priority routes would be 10 minutes in peak and 15 minutes in off-peak periods.

Figure 3-15: Transit Service Included in Transit Focus Scenario



Pricing Focus Scenario

With the same roadway and transit infrastructure as the 2025 Baseline Scenario, Pricing Focus Scenario assumed that all freeways and arterials in the Vancouver/Portland study area would be tolled according to demand and capacity conditions. It is believed that value pricing can encourage some users to alter their travel behavior (particularly during congested times) by using other routes, shifting to transit or carpools, changing their destinations (making shorter trips), and even potentially changing their time of travel or eliminating some trips. Consequently, more efficient use of existing transportation system capacity could be achieved. The Pricing Focus Scenario was to evaluate how much delay could be reduced on the existing transportation network by introducing value pricing.

Figure 3-16: Toll Levels in the Pricing Focus Scenario



The Pricing Focus Scenario tested effects of applying tolls to all highway links. The tolls would vary depending on congestion levels. Expressed in current dollars, tolls would vary from zero at times of low demand (i.e., no congestion), and rise with increasing demand/delay to 50 cents per mile when roadways are highly congested and demand meets or exceeds capacity. To illustrate the Pricing Focus Scenario, Figure 3-16 shows a map of the Vancouver region with roadway facilities marked with either a “high” or “low” toll level. Using the value pricing method previously described, facilities with a high tolling level are those that would have relatively high levels of traffic congestion, such as regional freeways, state highways, and major arterials. Facilities denoted with a low toll level are those that would have relatively low congestion levels prior to the introduction of value pricing. Most of the lower classification regional and local highways, as well as rural highways in the study area, would fall into this category.

One should note that the 2025

Baseline transit network was also used, which insufficiently serves the north and east parts of the study area. A route shift of vehicle trips, or more people driving longer distances to Park-and-Rides to use transit are likely to occur where the transit services are lacking.

Mixed-Mode Scenarios

The mid-range scenarios were developed so as to achieve data points with approximately 30% and 70% additional lane miles (highway) or transit service hours (transit) of the highway focus and transit focus scenarios.

Mixed Scenario — Highway and Transit Intensive

The Highway and Transit Intensive Mixed Scenario combined the improvements on the most congested facilities of the Highway Focus and Transit Focus Scenarios (see Figures 3-17 and 3-18). Its purpose was to test the extent to which congestion could be relieved by investing aggressively in both highway and transit improvements.

The highway capacity includes most of the freeway lane additions from the Highway Focus Scenario. In comparison with the Highway Focus Scenario, the number of lanes was scaled back from some freeways. Several of the arterial lanes from the Highway Focus Scenario were also scaled back in portions of the region where congestion levels were not too severe. Overall, over 70 freeway lane miles and over 150 arterial lane miles were added in this scenario, compared to the 2025 Baseline.

This scenario includes a high level of transit investment compared to the 2025 Baseline Scenario, although not as much as the Transit Focus Scenario. Upon examining the Transit Focus Scenario's ridership forecasts, the low usage HCT facilities were identified and replaced by the express buses operating at 15-minute peak period headways.

When compared to the Transit Focus Scenario, headways were lengthened on those routes operating less than half full at peak load point. This scenario provides 1,900 weekday bus equivalent revenue hours (400 fewer daily service hours than the Transit Focus).

Mixed Scenario — Highway Emphasis

The Highway Emphasis Mixed Scenario had the same level of highway investment as in the Highway and Transit Intensive Mixed Scenario (see Figure 3-17), but it included a lower level of transit investment (Figure 3-18). Its purpose was to test the degree to which lowering the level of transit infrastructure and service affects congestion levels, while keeping the highway investment fixed.

The Highway Emphasis Mixed Scenario also includes improvements in transit service that go beyond those included in the 2025 Baseline Scenario but are less than the service levels included in either the Transit Focus or the Highway or Transit Intensive Mixed Scenarios. Most peak-period headways are less than or equal to 30 minutes. Compared to the Highway and Transit Intensive Mixed Scenario, headways would be lengthened on those routes operating less than half full at peak load point. Total transit service supplied would be about 1,420 revenue hours per weekday. The transit improvements contained in the Highway Emphasis Scenario are shown in Figure 3-19.

Figure 3-17: Additional Highway Improvements in the Highway and Transit Intensive & Highway Emphasis Scenarios

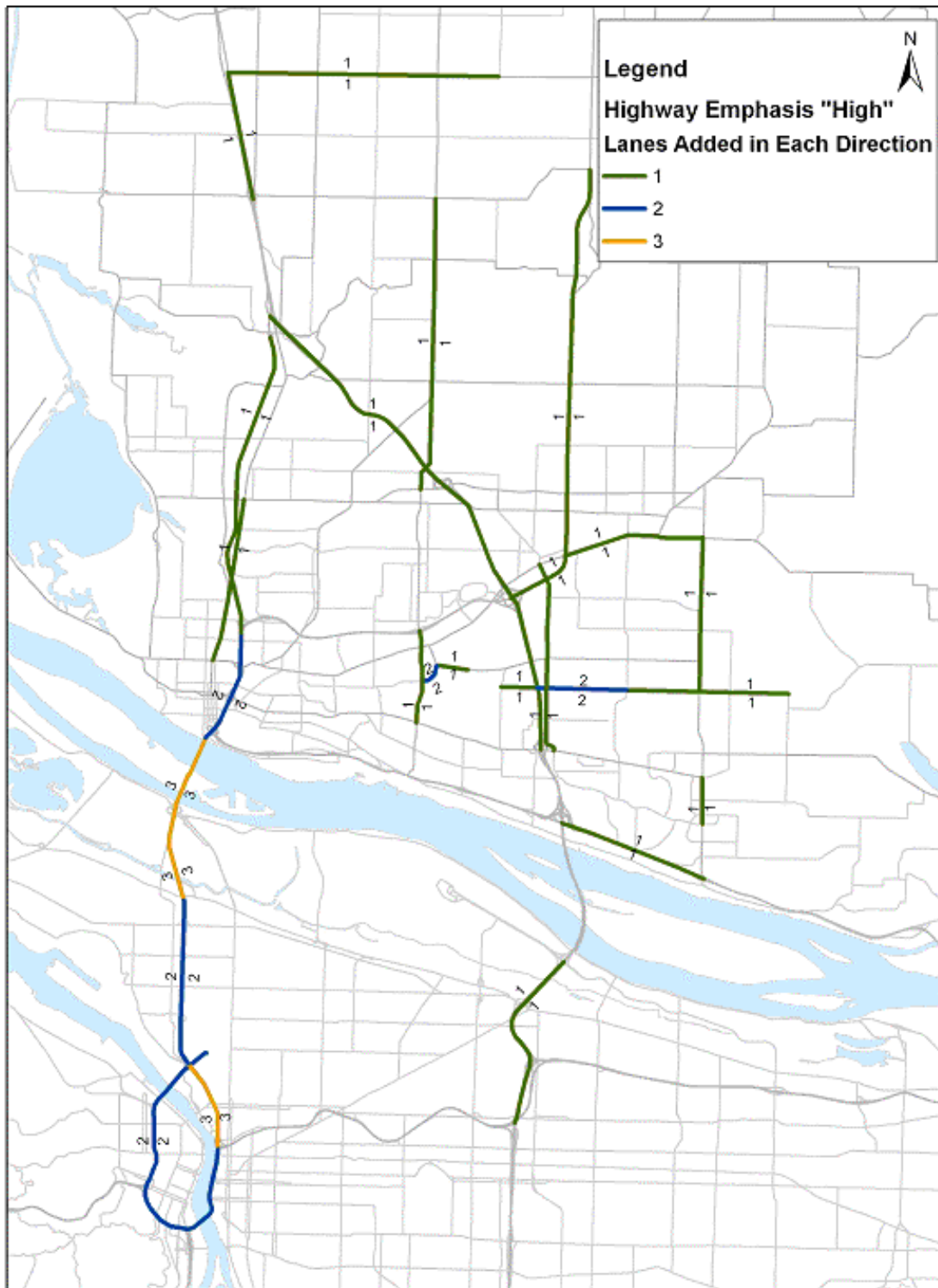


Figure 3-18: Transit Improvements in the Highway and Transit Intensive and Transit Emphasis Scenarios

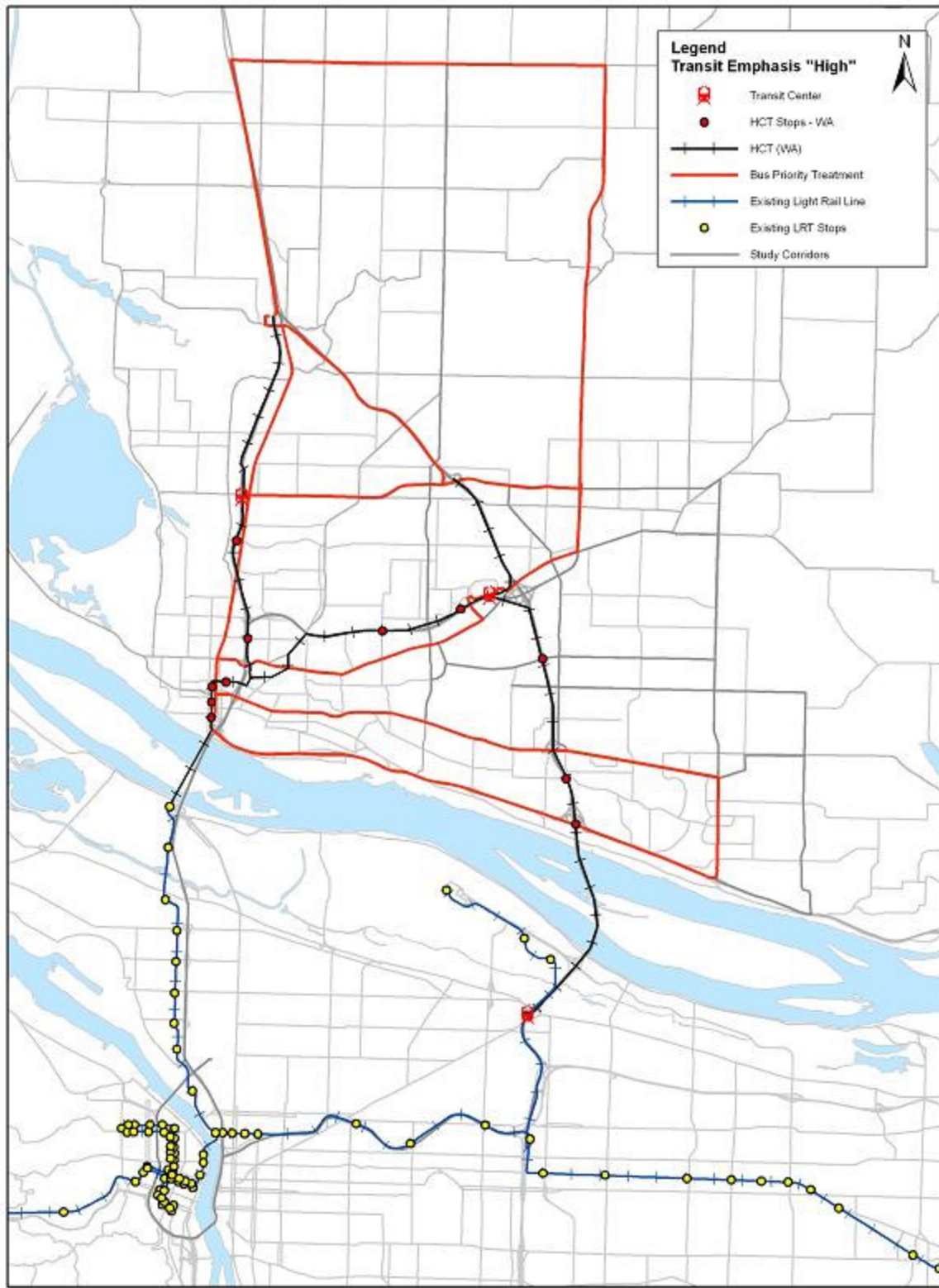
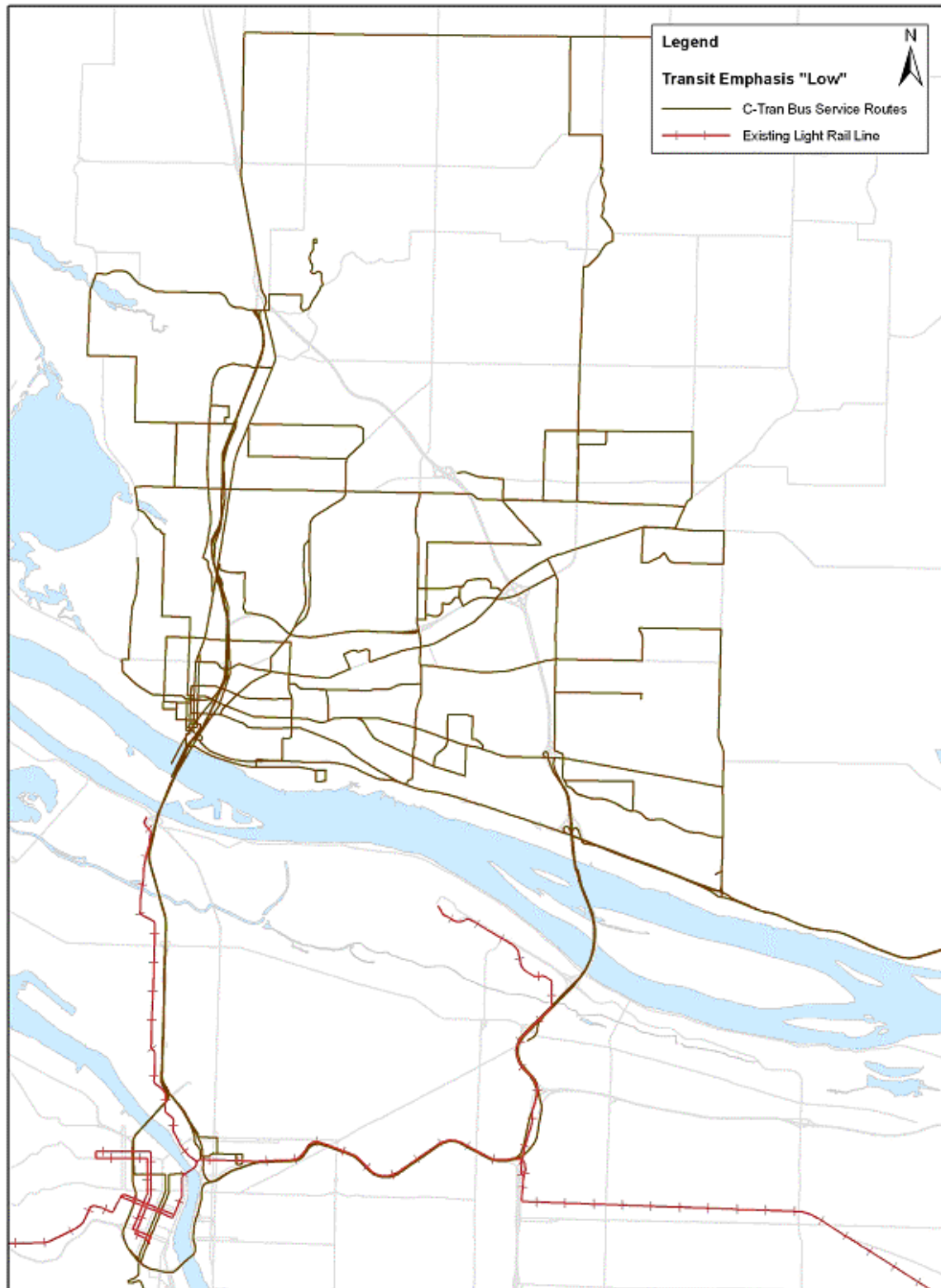


Figure 3-19: Transit Improvements contained in the Highway Emphasis Scenario



Mixed Scenario — Transit Emphasis

The Transit Emphasis Mixed Scenario included the same level of transit investment as in the Highway and Transit Intensive Mixed Scenario, but it had a lower level of highway investment (Figure 3-20). This scenario includes additional road capacity, with 74 more freeway and arterial lane miles than the 2025 Baseline Scenario, which represents approximately 40% of the Highway Focus Scenario. Its purpose was to test the degree to which scaling back the level of highway infrastructure affects congestion levels, while keeping the transit investment fixed.

Mixed Scenario — Transit Emphasis with Pricing

The Transit Emphasis with Pricing Mixed Scenario began with the same level of highway and transit investment as described for the Transit Emphasis Mixed Scenario. It then added value pricing on all freeways that contained at least one additional lane of freeway capacity (Figure 3-21). The tolls paid by travelers on the freeway system would vary by time-of-day and level of congestion. Table 3-6 shows three examples that illustrate a typical toll that might apply during peak periods on several lengthy commuter routes. The purpose of this scenario was to test whether selective pricing of roadways could reduce congestion, employing value pricing as a substitute for adding more roadway capacity. This scenario also tested the interaction of value pricing with a high level of transit investment.

Table 3-6 Sample Tolls for PM Peak Period Commutes

From	To	Miles	Toll Rate per Mile	Total Toll
Portland	Vancouver	10	\$0.40 - \$0.50	\$4.00 - \$5.00
Vancouver	Battle Ground	18	\$0.20 - \$0.25	\$3.60 - \$4.50
Salmon Creek	Portland Airport	14	\$0.15 - \$0.20	\$2.10 - \$2.80

Mixed Scenario — Transit Emphasis with Transportation Demand Management

The Transit Emphasis with Transportation Demand Management (TDM) Mixed Scenario includes the same level of highway and transit investment as described under the Transit Emphasis Mixed Scenario. It also assumed expansion of TDM programs in major community centers in Vancouver. To represent the expanded TDM programs in the model, parking costs were increased or assumed in these community centers. Other TDM programs assumptions included transit fare subsidies, bike, walk, carpool and rideshare incentive programs, and telecommuting.

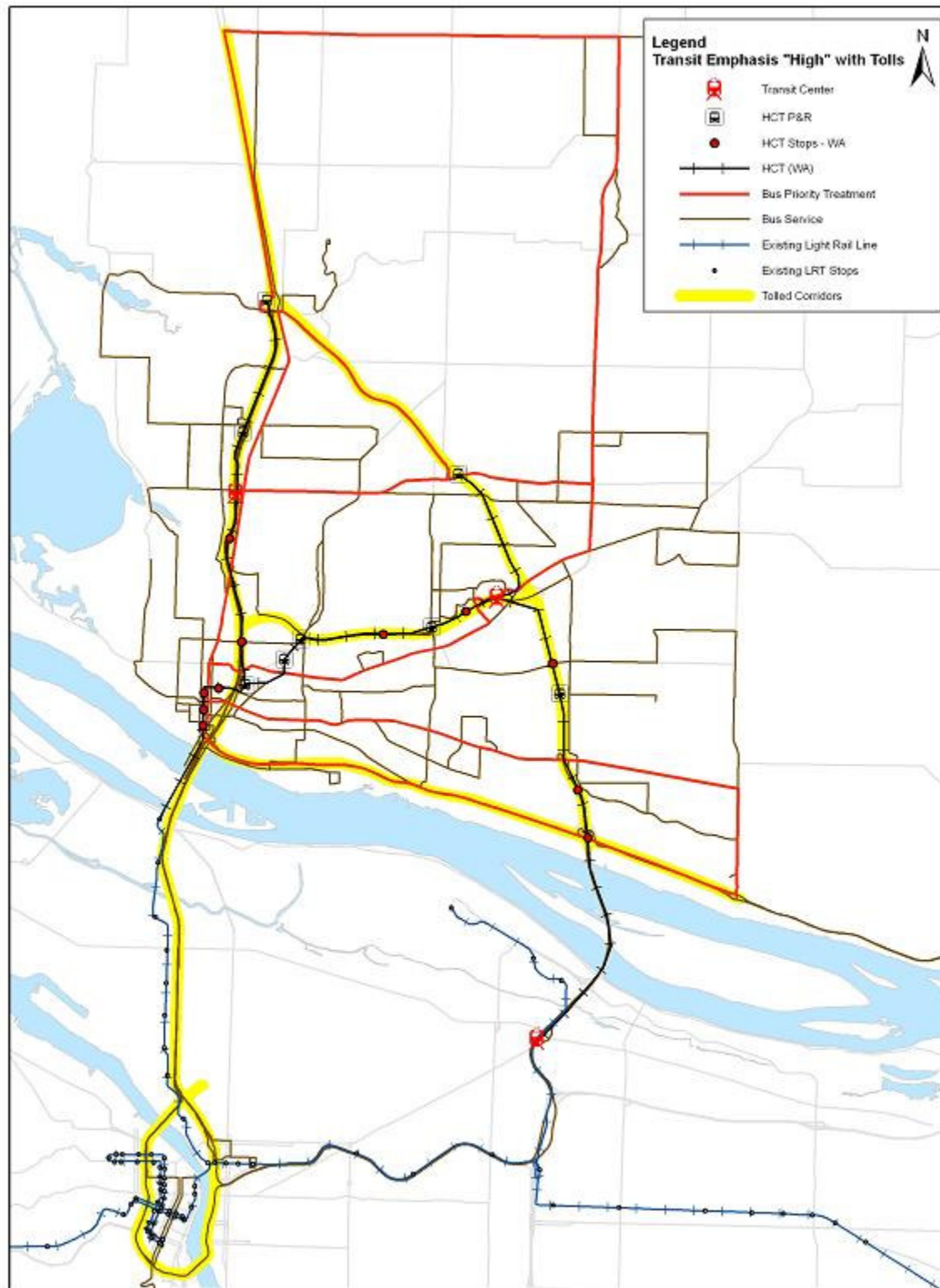
Expanded TDM programs were included in the following centers:

- Vancouver Central Business District
- Hazel Dell
- Salmon Creek
- Vancouver Mall
- Cascade Park
- Fisher's Landing

Figure 3-20: Highway Improvements contained in the Transit Emphasis Scenarios



Figure 3-21: Tolled Corridors in the Transit Emphasis with Pricing Mixed Scenario



3.6 Evaluation Results

Transportation Analysis

A series of transportation analysis metrics was developed to assess and compare the scenarios for how well they address congestion. The performance of each scenario was modeled. Table 3-7 shows the specific analysis metrics used in this analysis. The indicators include a mixture of system-level and corridor-specific measures.

Table 3-7 Transportation Analysis Metrics

Analysis Metric	Definitions
Vehicle Hours of Delay	The amount of delay (per vehicle) experienced either daily or during the 2-hour PM peak period.
Commercial Vehicle Hours of Delay	The amount of delay experienced by trucks either daily or during the 2-hour PM peak period.
Vehicle Delay per Mile	The intensity of delay experienced by vehicles on the state highway system measured as total daily delay per mile.
Congested Hours per Day	The number of hours per day during which a corridor is congested in the peak direction of travel
Travel Times	The time it takes to travel, either via car or transit, during the PM peak period for a set of typical trips in the region.
Person Volumes (Columbia River Crossing)	The number of people traveling on a facility during a day or during a 2-hour peak period.
Vehicle Miles of Travel	The number of miles all vehicles travel either for an entire day or during the PM peak period.
Mode Share	The number of people traveling by transit, carpool, or alone in their cars, averaged for an entire day or for the PM peak period.
Transit Ridership Potential	The potential for high capacity transit usage within a designated corridor.

Vehicle Hours of Delay (VHD) and Delay per Vehicle Trip

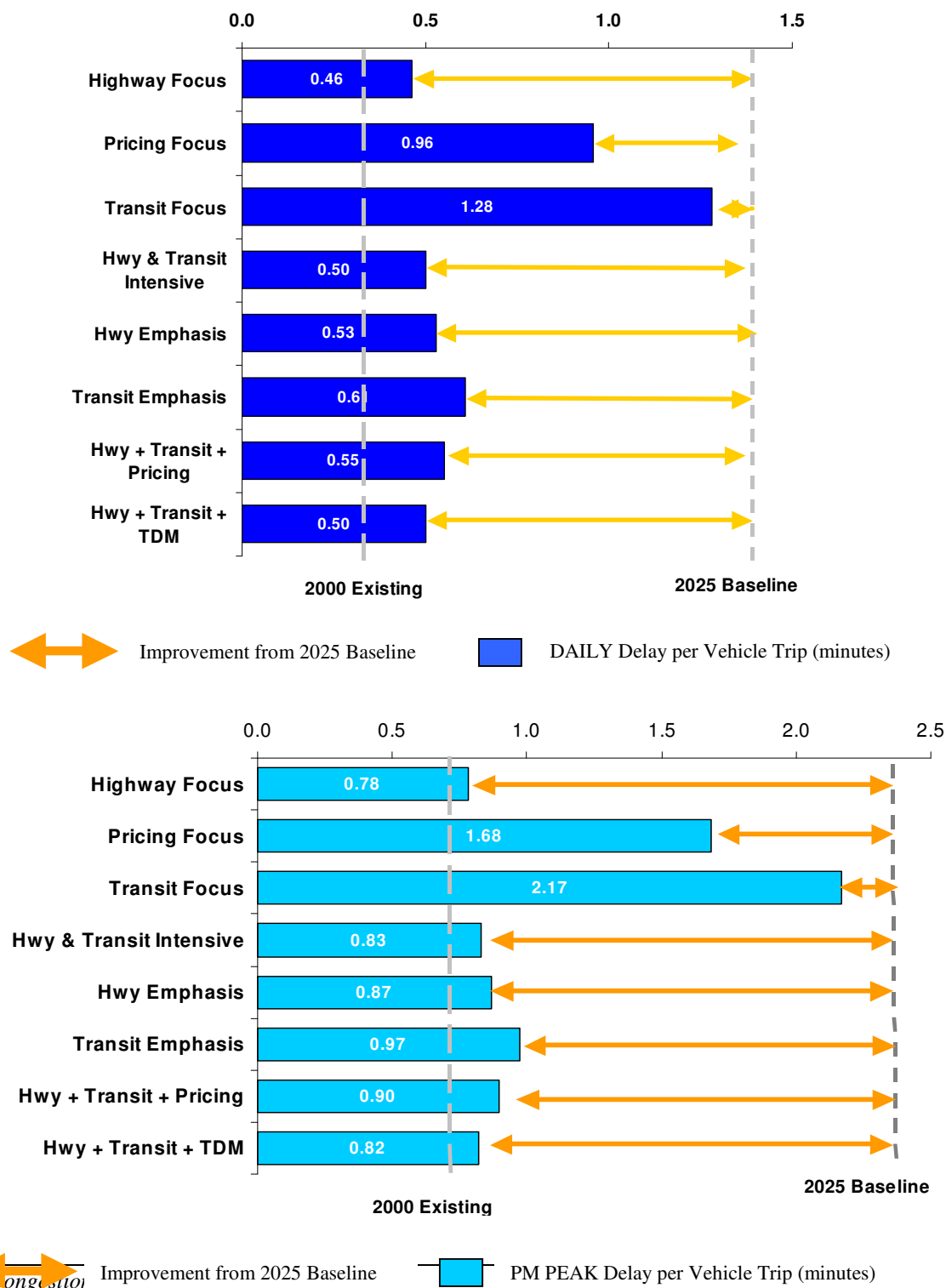
Vehicle hours of delay measures the delay experienced by vehicles. There are two measures used: 1) average delay per vehicle, which provides the average time delay for each vehicle trip generated in the region during the day and during the PM peak period, and 2) total vehicle hours of delay, which measures the daily and PM peak period delay experienced by all vehicles. Delay is defined as the difference between highway speeds when traffic is operating at free flow conditions (typically near or at the speed limit) and the speed resulting from the traffic conditions in the scenario being modeled.

Average Delay per Vehicle Trip

The comparison of average daily and PM peak period delay per vehicle trip for all scenarios is shown in Figure 3-22. During the PM peak period, the average delay per vehicle in 2000 Existing condition is slightly more than 0.7 minute per trip and, in the 2025 Baseline Scenario, the delay would increase to 2.4 minutes per vehicle trip. The improvement scenarios would reduce peak period delays in similar proportions to those reported for daily conditions. The Pricing Focus and Highway Focus Scenarios reduce the average daily delay to a level slightly higher than existing conditions, while the Transit Focus Scenario's delay per vehicle

slightly decreases compared to 2025 Baseline but is still 50% above existing conditions. Most of the mixed scenarios would have delays that are at least 60-70% lower than the 2025 Baseline and are just slightly above existing conditions.

Figure 3-22: Average Delay per Vehicle Trip

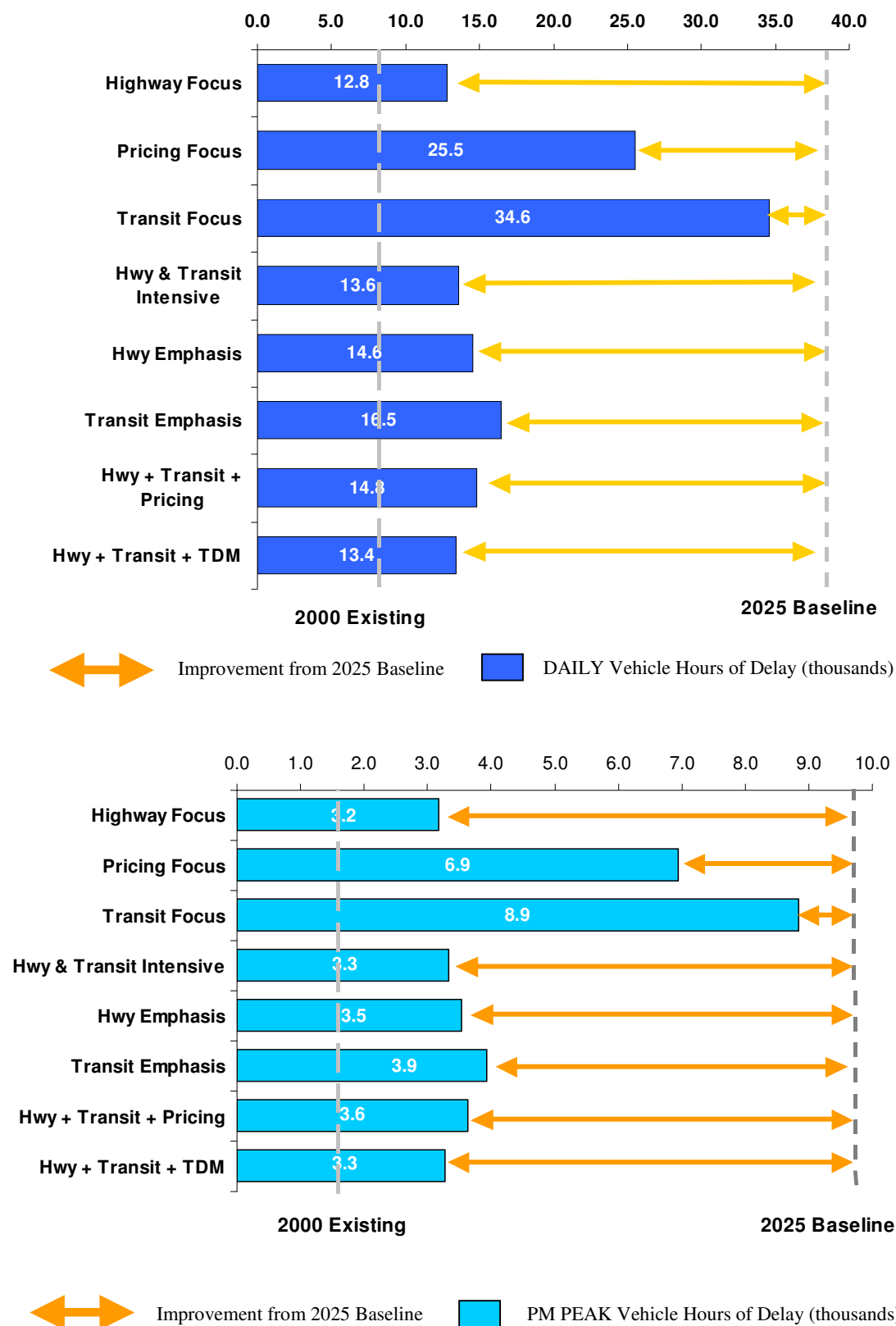


Total Vehicle Hours of Delay

A comparison of total daily and PM peak period vehicle delay for all scenarios is shown in Figure 3-23. In the 2025 Baseline Scenario, the daily total vehicle hours of delay would increase nearly 500% compared with existing conditions. Five scenarios (Highway Focus Scenario, Highway and Transit Intensive Scenario, highway Emphasis Mixed Scenario, Highway and Transit with Pricing Scenario, and Highway and Transit with TDM Scenario) would reduce daily vehicle hours of delay to levels that are substantially lower than the 2025 Baseline Scenario but are 70 to 80% higher than existing delay. The Transit Emphasis with Pricing Mixed Scenario would achieve similar reductions in delay to the Highway Focus Scenario. The Transit Focus Scenario would achieve minimal reductions in daily vehicle delay. During the PM peak period, the hours of delay for all the scenarios would reflect the same trends as shown for daily.

The Pricing Focus Scenario would result in daily reductions comparable to several other scenarios. However, it would achieve this by reducing vehicle use as reflected in certain trips shortening travel distances and some trips use other travel options. In terms of the economic benefits of value pricing (discussed later in this report), it is also necessary to consider the disbenefits to users who make compromises in their travel behavior in order to minimize transportation costs.

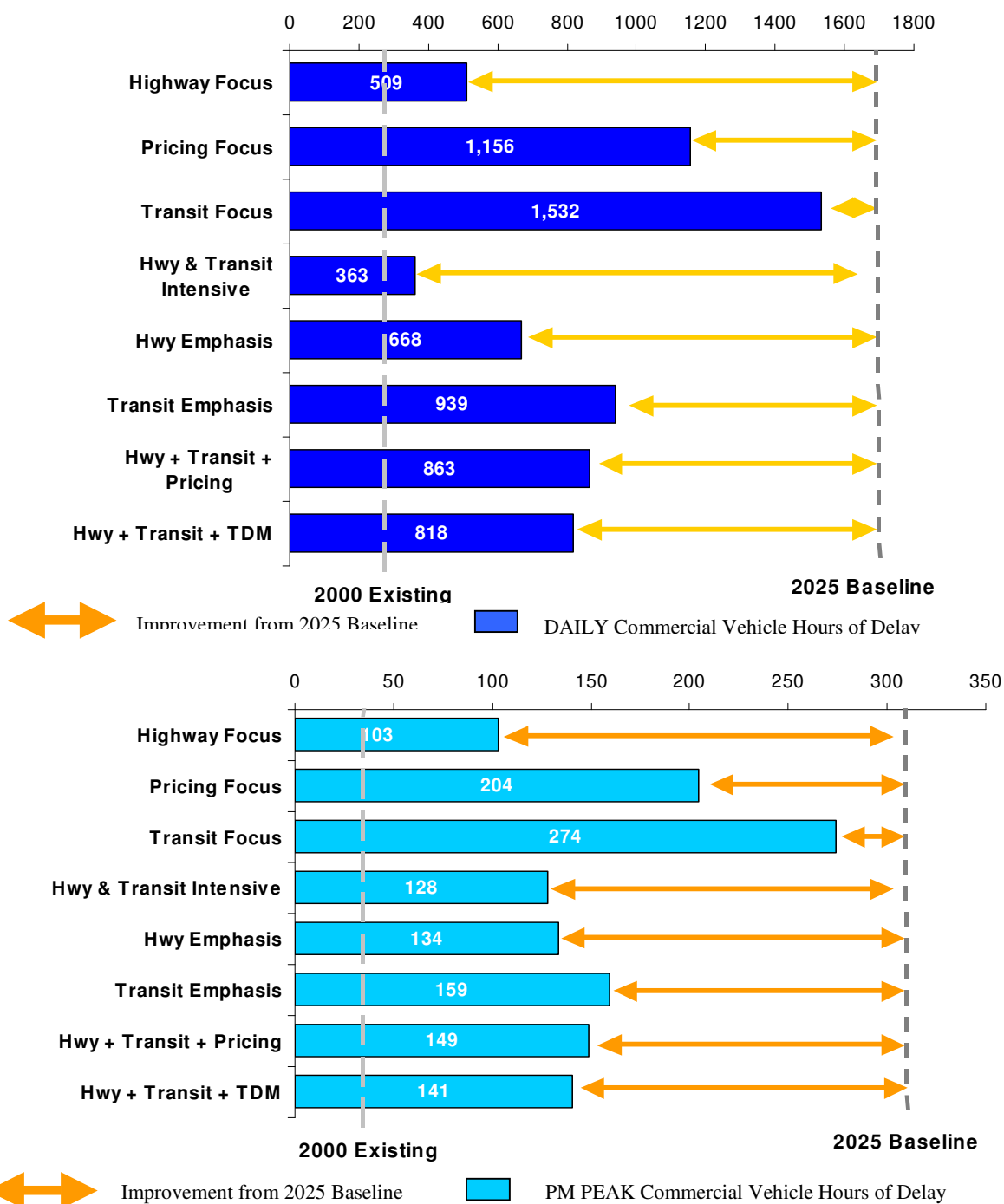
Figure 3-23: Total Vehicle Hours of Delay



Commercial Vehicle Hours of Delay (daily)

Figure 3-24 summarizes the commercial vehicle hours of delay for each scenario. In the 2025 Baseline Scenario, the daily total truck hours of delay would increase more than 600% compared with existing conditions. The model results show that the scenarios that include more highway capacities generally yield more delay reductions during both daily and PM peak period.

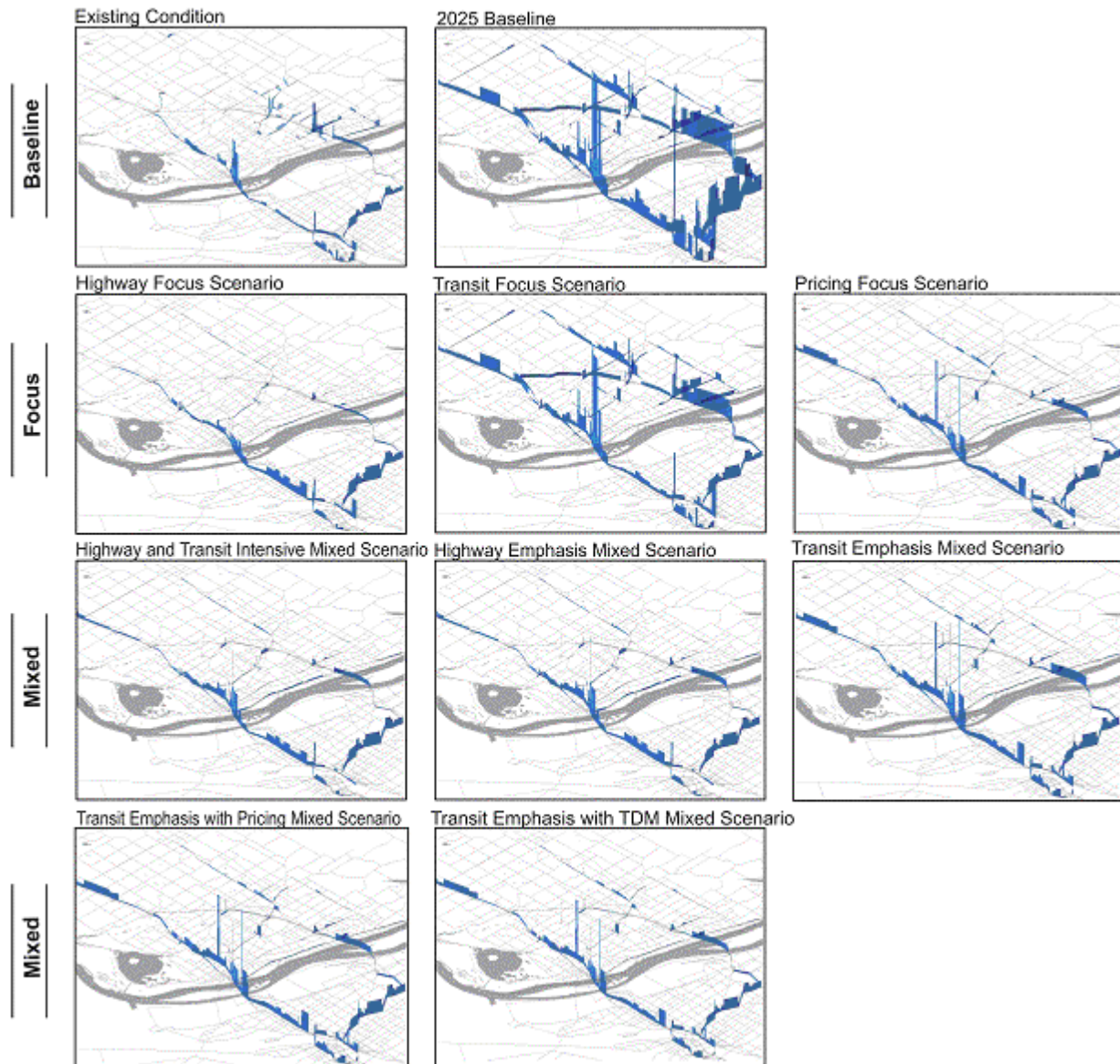
Figure 3-24: Commercial Vehicle Hours of Delay



Vehicle Delay per Mile (peak period)

According to the model results, delay per mile in the 2025 Baseline Scenario would increase significantly compared to the existing condition. Figure 3-25 shows the total vehicle hours of delay per mile for each highway segment in the evaluated scenarios. The higher the bars in the figure show the longer the delay per mile on the highway system.

Figure 3-25: Vehicle Delay per Mile



Congested Hours per Day

Duration of congestion is an indicator of the number of hours during a typical weekday the roadway might be congested. A “post-processing” tool was developed to estimate congestion duration based on the model outputs. Figure 3-27 illustrates the estimated congestion duration for the scenarios. Table 3-8 provides a numerical comparison.

Existing Conditions vs. 2025 Baseline

Currently, the average duration of congestion is approximately 0.7 hour per direction system-wide, with approximately 1.5 hours for freeways (per direction) and half hour per direction for arterials. For the 2025 Baseline Scenario, the average duration of congestion expands to almost 3 hours per direction system-wide, with an average of 3.2 hours per direction for freeway, and an average of 1.3 hours per direction for arterial.

Congestion levels on the Columbia River crossing corridors (I-5 and I-205) were projected to increase much more significantly than overall corridors within Clark County. I-5 duration of congestion would increase from 1-3 hours per direction (higher in Portland than in Vancouver) in 2000 to 3-5 hours per direction in the 2025 Baseline. I-205 congestion would increase from 1-2 hours per direction in 2000 to 3-7 hours per direction in the 2025 Baseline. For other corridors, the largest increases would occur on 162nd/164th Avenue (increasing from less than 1/2 hour to 1 hour per direction in 2000 to 1-2 hours per direction in the 2025 Baseline).

Highway Focus vs. 2025 Baseline

Compared with the 2025 Baseline, all of the corridor congestion levels in the Highway Focus Scenario would be reduced. The average congestion duration drops from 2.9 to 1.1 hours per direction system-wide. More specifically, a drop from 3.2 to 1.3 hours was projected for freeways, and a drop from 1.3 to 0.3 hours for arterials. These levels are comparable to existing levels of congestion. Corridors that benefit most from the Highway Focus Scenario investment include I-5 from downtown Portland to Hazel Dell, I-205 from I-84 to SR 500, and SR 502 and SR 503.

Transit Focus vs. 2025 Baseline

The freeways congestion levels in the Transit Focus Scenario would be reduced slightly. Congestion on arterials does not show any change. Congestion duration would be reduced on I-5, I-205, and SR 500 with high capacity transit lines. No change was found for other corridors.

Pricing Focus vs. 2025 Baseline

The average congestion drops from 3.2 to 1.8 hours per direction on freeways and for arterials congestion decreases from 1.3 to 0.9 hours per direction. Duration of congestion is similar to existing conditions on freeways but is higher than existing for arterials. Corridors that benefit most from the Pricing Focus Scenario investment include I-5 and I-205, SR 500, SR 502/ SR 503, and 162nd/164th Avenue. The increase in arterial duration of congestion compared to existing conditions appears to be due to diversion of traffic from more congested freeways (and thus higher tolls) onto less-congested arterials (and thus lower tolls).

Highway and Transit Intensive Mixed vs. 2025 Baseline

The model indicated that all of the corridor congestion levels would be lower than the 2025 baseline. The average congestion drops from 2.9 to 1.3 hours per direction system-wide. In average, a drop from 3.2 to 1.5 hours per direction on the freeways and a drop from 1.3 to 0.4

hours per direction on arterials would be expected. This would bring the congestion duration to be comparable to the existing conditions.

Transit Emphasis Mixed with Pricing

When freeway tolling is added to the Transit Emphasis Mixed Scenario, the model indicated a reduction in congestion duration from 1.7 hours to 1.6 hours per direction comparing to the results of the Transit Emphasis Mixed Scenario. The model showed that the added value pricing strategy would benefit I-5 and I-205 most. The congestions on the arterials in the study area did not show any alleviation under the Transit Emphasis Mixed with Pricing Scenario compared to the transit emphasis without value pricing. This is likely due to the arterials not being priced (compared to the Pricing Focus Scenario).

Transit Emphasis Mixed vs. Transit Emphasis with TD) Mixed

The effects of expanding transportation demand management programs in community centers in Clark County were modeled using increased parking costs as surrogate. The expanded TDM programs to the Transit Emphasis Mixed Scenario reduces average corridor congestion from 1.7 hours to 1.5 hours per direction, which is the lowest average congestion duration among the mixed mode scenarios tested.

Figure 3-26: Congested Hours per Day in the Evaluated Scenarios

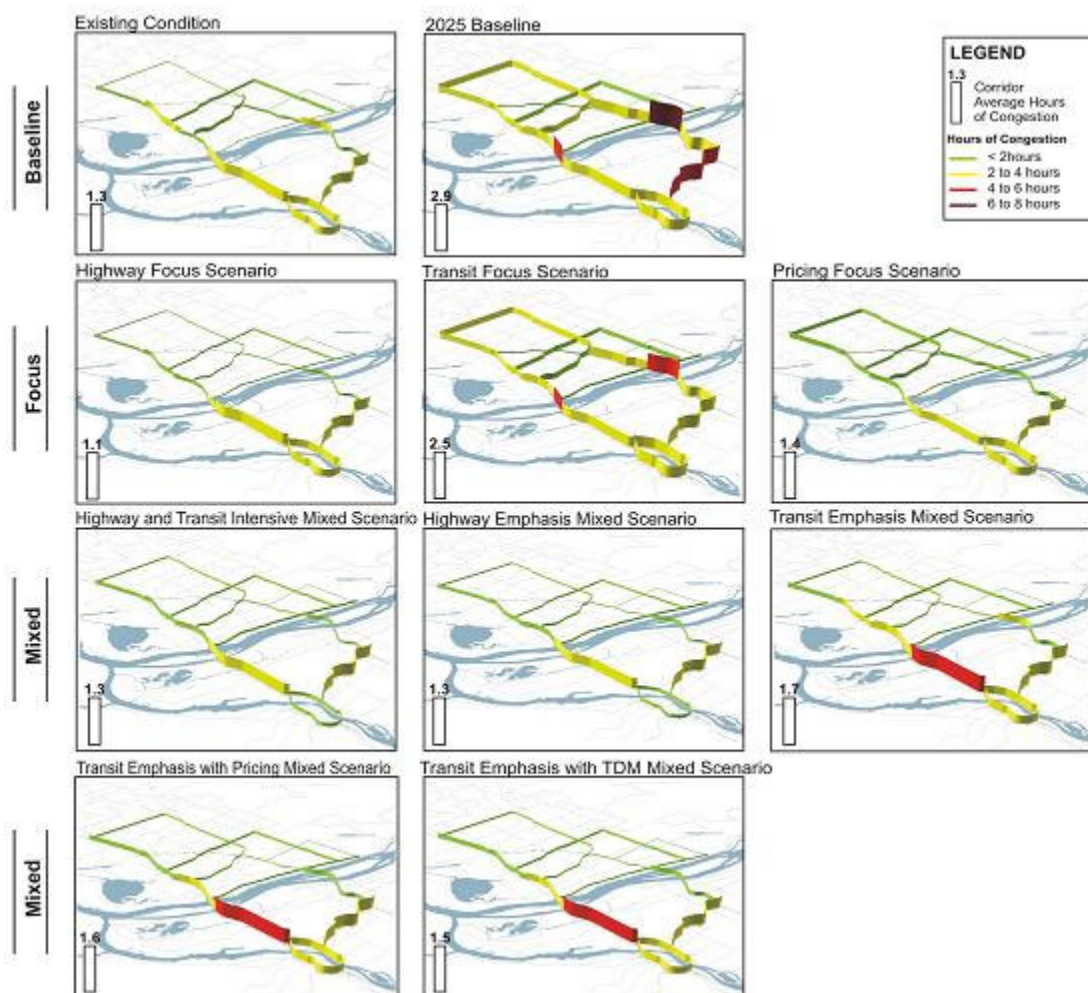


Table 3-8 Estimated Current and Projected Future Hours of Congestion per Day

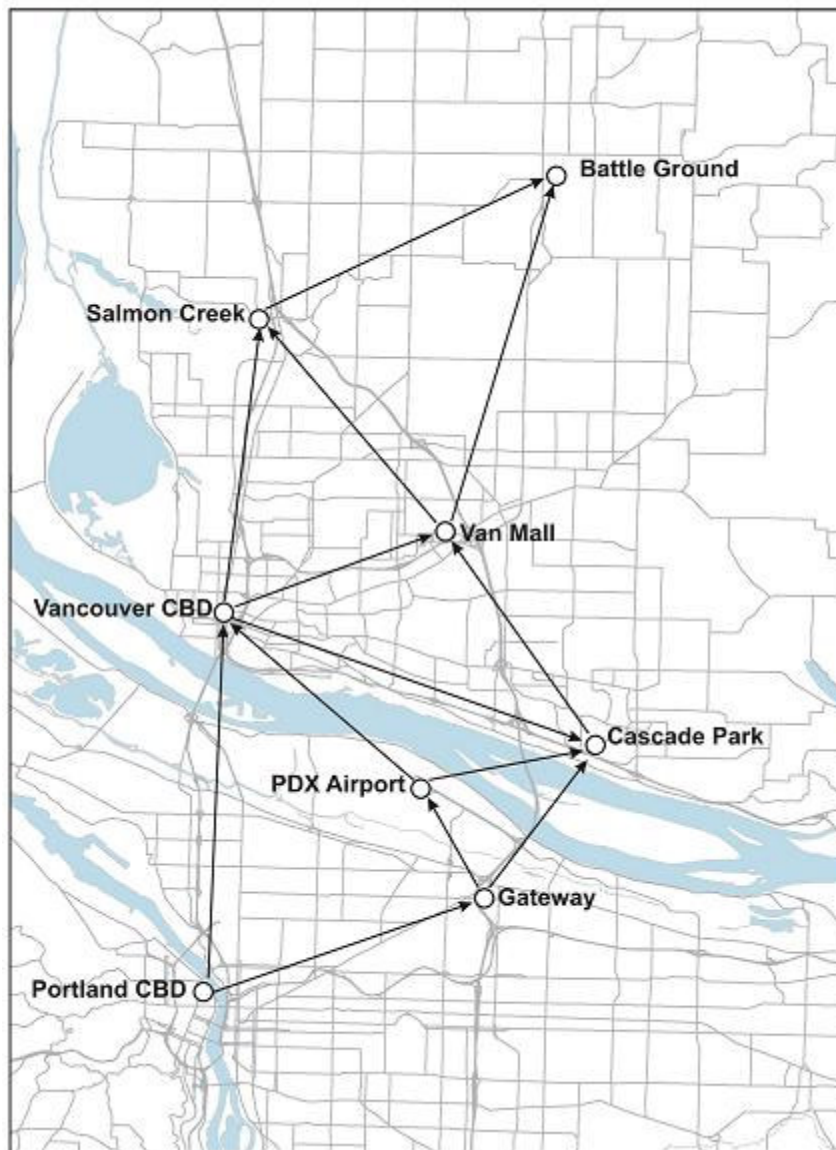
#	Corridor	Existing (2000)	2025 Baseline	Hwy Focus	Pricing Focus	Transit Focus	Hwy & Transit Emphasis	Highway Emphasis	Transit Emphasis	Transit Emphasis w/Pricing	Transit Emphasis w/TDM
1	I-5 Bridge	3	6	2	2	4	3	3	3	3	3
2	I-5 Central	1	3	1	2	2	2	2	3	2	2
3	I-5 Hazel Dell	2	2	1	2	2	2	2	2	2	2
4	I-5 North	1	2	1	2	2	1	1	2	2	2
5	I-205 Bridge	2	7	1	1	6	1	1	2	2	2
6	I-205 South	1	4	0	1	3	0	0	0	0	0
7	I-205 North	0	0	0	0	0	0	0	0	0	0
8	SR 14	0	1	0	0	1	1	1	1	1	0
9	SR 500	1	2	1	1	2	1	1	1	1	1
10	NE 162 nd Ave/NE Padden Pkwy	1	2	1	1	1	1	1	1	1	1
11	SR 502/SR 503	0	2	0	1	2	1	1	1	1	1
12	NE 18 th St/192 nd Ave	0	0	0	0	0	0	0	0	0	0
13	I-5 N Portland	3	3	3	2	3	3	3	5	4	4
14	Banfield Freeway	3	5	3	3	4	3	4	4	4	3
15	I-205 N Portland	1	4	1	1	3	1	1	1	1	1
16	Portland CBD Loop	2	3	2	2	3	1	1	2	2	2
System-Wide		Existing (2000)	2025 Baseline	Highway Focus	Pricing Focus	Transit Focus	Hwy & Transit Emphasis	Highway Emphasis	Transit Emphasis	Transit Emphasis w/Pricing	Transit Emphasis w/TDM
	OVERALL	1	3	1	1	2	1	1	2	2	1
	- Freeways/Expressways	2	3	1	2	3	1	1	2	2	2
	- Arterials	0	1	0	1	1	0	0	0	0	0

Travel Times between Major Activity Centers

Major activity centers were chosen as the origins (beginning) and the destinations (the end of the trip) for determining point-to-point travel times for the peak 2-hour period in the afternoon.⁴ The major activity centers include the Vancouver and Portland central business districts, Vancouver Mall, Portland Airport, Salmon Creek (134th Street at I-5), Cascade Park (east of I-205 along Mill Plain Boulevard), and Battle Ground. Figure 3-27 shows 13 selected origins and destinations for travelers in the Vancouver/Portland region.

Travel times were estimated separately for trips in vehicles (non-HOV cars and trucks) and for trips on transit. The results vary considerably among the scenarios.

Figure 3-27: Key Origins and Destinations for Travel Time Comparisons



⁴ This is typically referred to as the PM Peak Period and generally occurs between 4:00 PM and 6:00 PM.

General Purpose Traffic

Table 3-9 shows the model results of travel times in different scenarios. It is found that the average travel times of non-HOV vehicular traffic during the evening peak period along these selected routes are expected to increase by almost 50% in the 2025 Baseline. The vehicle trip from downtown Portland to downtown Vancouver, for example, is expected to increase from 30 minutes under the 2000 conditions to over 54 minutes in the 2025 Baseline. Correspondingly, the same trip on transit is also expected to increase significantly during that same time period, from 39 to over 70 minutes (see transit travel time summary Table 3-10).

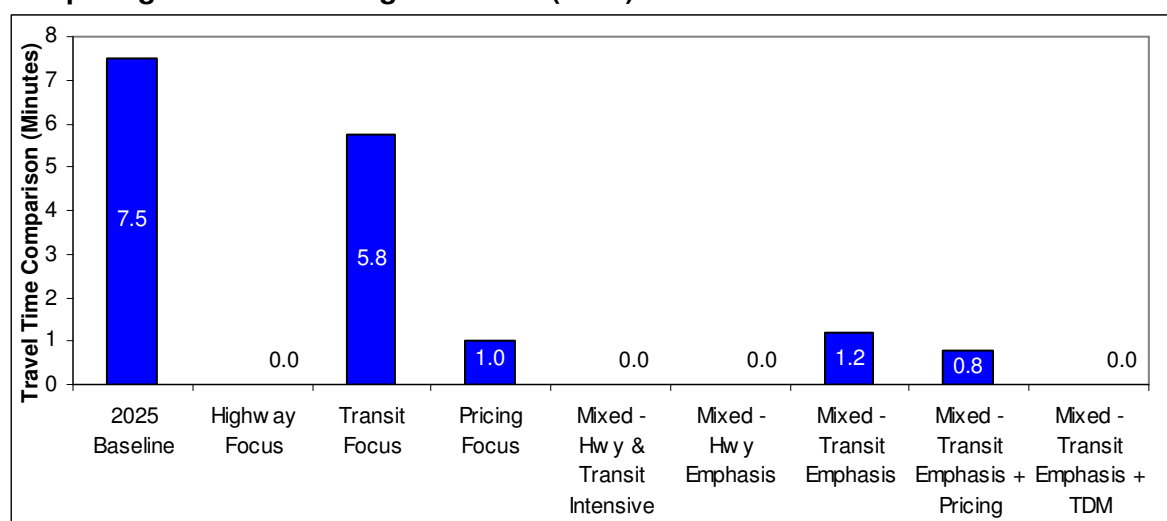
Table 3-9 Modeled Point-to-Point Travel Time for General-Purpose Traffic (in Minutes during PM Peak Period)

Commuter Routes Between:	2000 Existing	2025 Baseline	Highway Focus Scenario	Pricing Focus Scenario	Transit Focus Scenario	Hwy & Transit Intensive Mixed Scenario	Highway Emphasis Mixed Scenario	Transit Emphasis Mixed Scenario	Transit Emphasis w/Pricing	Transit Emphasis w/TDM
Van CBD to Van Mall	12	14	13	13	13	13	13	13	13	12
Van CBD to Salmon Crk	13	16	13	15	16	13	13	14	14	13
Van CBD to Cascade Park	11	12	11	11	11	12	12	12	12	11
Cascade Park to Van Mall	8	10	9	9	10	9	9	10	9	9
Van Mall to Salmon Crk	10	15	12	13	15	12	12	12	12	12
Van Mall to Battle Ground	18	24	19	22	23	19	19	20	20	20
Salmon Crk to Battle Ground	16	19	16	19	19	18	18	18	18	17
Portland CBD to Van CBD	30	54	24	31	48	23	23	29	27	26
Portland CBD to Gateway	23	29	24	21	27	23	23	25	24	22
Gateway to PDX Airport	12	17	15	14	16	14	14	15	14	14
Gateway to Cascade Park	13	27	12	13	24	12	12	14	13	13
PDX Airport to Van CBD	23	36	24	23	33	24	24	25	24	24
PDX Airport to Cascade Park	18	32	19	17	28	18	18	20	19	18
Overall Average for 13 Routes	16	24	16	17	22	16	16	17	17	16

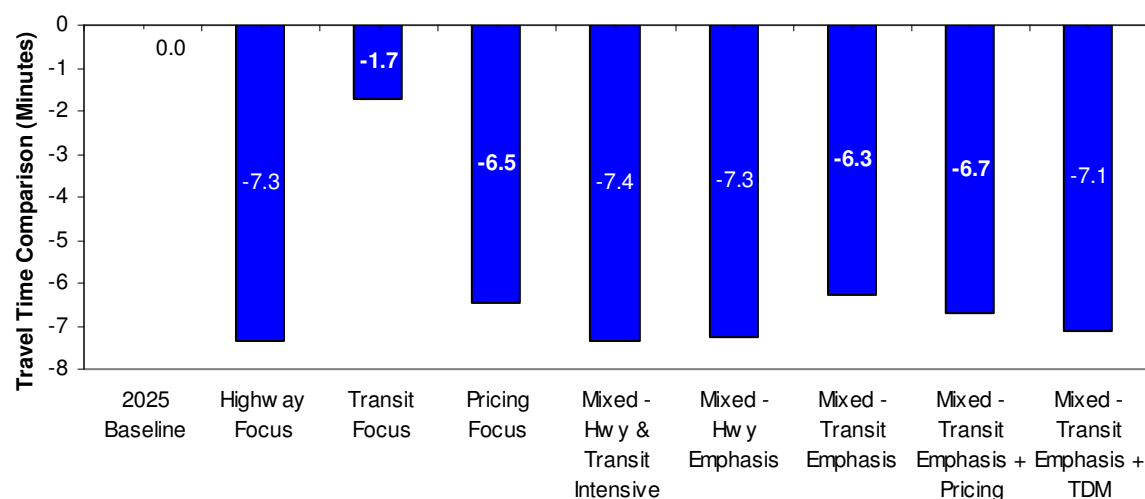
The Highway Focus Scenario, and the scenarios with mixed highway and transit investments would reduce an average of 7 minutes on travel time compared to the 2025 Baseline Scenario, and the Pricing Focus Scenario would have similar reductions (approximately 6 minutes per trip). The Transit Focus Scenario would achieve approximately 2 minutes of reduction on travel time. Average travel time for selected routes is summarized in Figure 3-28.

Figure 3-28: Average GP Travel Times Reduction for Selected Routes—PM Peak Period

Comparing with the Existing Condition (2000)



Comparing with the 2025 Baseline



Transit

Table 3-10 shows the point-to-point travel times for trips on transit for each scenario. Transit travel times include in-vehicle time, wait time, and transfer times. The average transit travel times are expected to increase slightly between the existing condition (2000) and the 2025 Baseline. Transit travel times on light rail corridors in Portland are not expected to increase between now and 2025. For bus traveling both on the congested freeway and arterials such as I-5 (Portland CBD to Vancouver CBD) and I-205 (Gateway to Cascade Park, Portland Airport to Cascade Park), transit travel times, however, will experience a significant increase. Transit travel times are expected to decrease slightly between 2000 and 2025 for trips between Vancouver CBD and Vancouver Mall (reflecting improvements to SR 500 between 2000 and 2025 Baseline) and Vancouver CBD to Salmon Creek (reflecting widening of I-5 between 2000 and 2025 Baseline).

Table 3-10 Modeled Point-to-Point Transit Travel Time (in minutes during PM Peak Period)

Commuter Routes Between:	2000 Existing	2025 Baseline	Highway Focus Scenario	Pricing Focus Scenario	Transit Focus Scenario	Hwy & Transit Intensive Mixed Scenario	Highway Emphasis Mixed Scenario	Transit Emphasis Mixed Scenario	Transit Emphasis w/Pricing	Transit Emphasis w/TDM
Van CBD to Van Mall	30	34	34	34	26	26	33	26	26	26
Van CBD to Salmon Crk	30	36	36	35	25	23	31	23	23	23
Van CBD to Cascade Park	50	54	54	54	30	30	37	30	30	30
Cascade Park to Van Mall	28	34	34	34	19	19	36	19	19	19
Van Mall to Salmon Crk	40	56	56	55	26	23	45	23	23	23
Van Mall to Battle Ground	44	57	57	56	43	35	62	35	35	35
Salmon Crk to Battle Ground	49	60	60	60	34	36	41	36	36	36
Portland CBD to Van CBD	40	71	72	50	36	33	37	33	33	33
Portland CBD to Gateway	20	26	26	26	30	31	30	31	31	31
Gateway to PDX Airport	19	28	28	28	51	26	26	26	26	26
Gateway to Cascade Park	37	76	76	64	22	22	62	22	22	22
PDX Airport to Van CBD	72	110	111	89	57	58	75	58	58	58
PDX Airport to Cascade Park	57	99	99	87	32	32	65	32	32	32
Overall Average for 13 Routes	40	57	57	52	33	30	45	30	30	30
Travel Time Savings Relative to Baseline	---	---	0	6	24	27	12	27	27	27

Compared to the 2025 Baseline Scenario, all of the scenarios that include a high level of transit investment (including a high capacity transit system within Clark County) would reduce the transit travel times 24 to 27 minutes. The Highway Emphasis Mixed Scenario saves

approximately 12 minutes on average per transit trip compared to the 2025 Baseline. However, the Highway Focus Scenario would save little or no travel time for trips on transit, as the transit network is the same in both instances. The Pricing Focus Scenario would save approximately 6 minutes on average compared to the 2025 Baseline due to reduced congestion on the arterial roadway system.

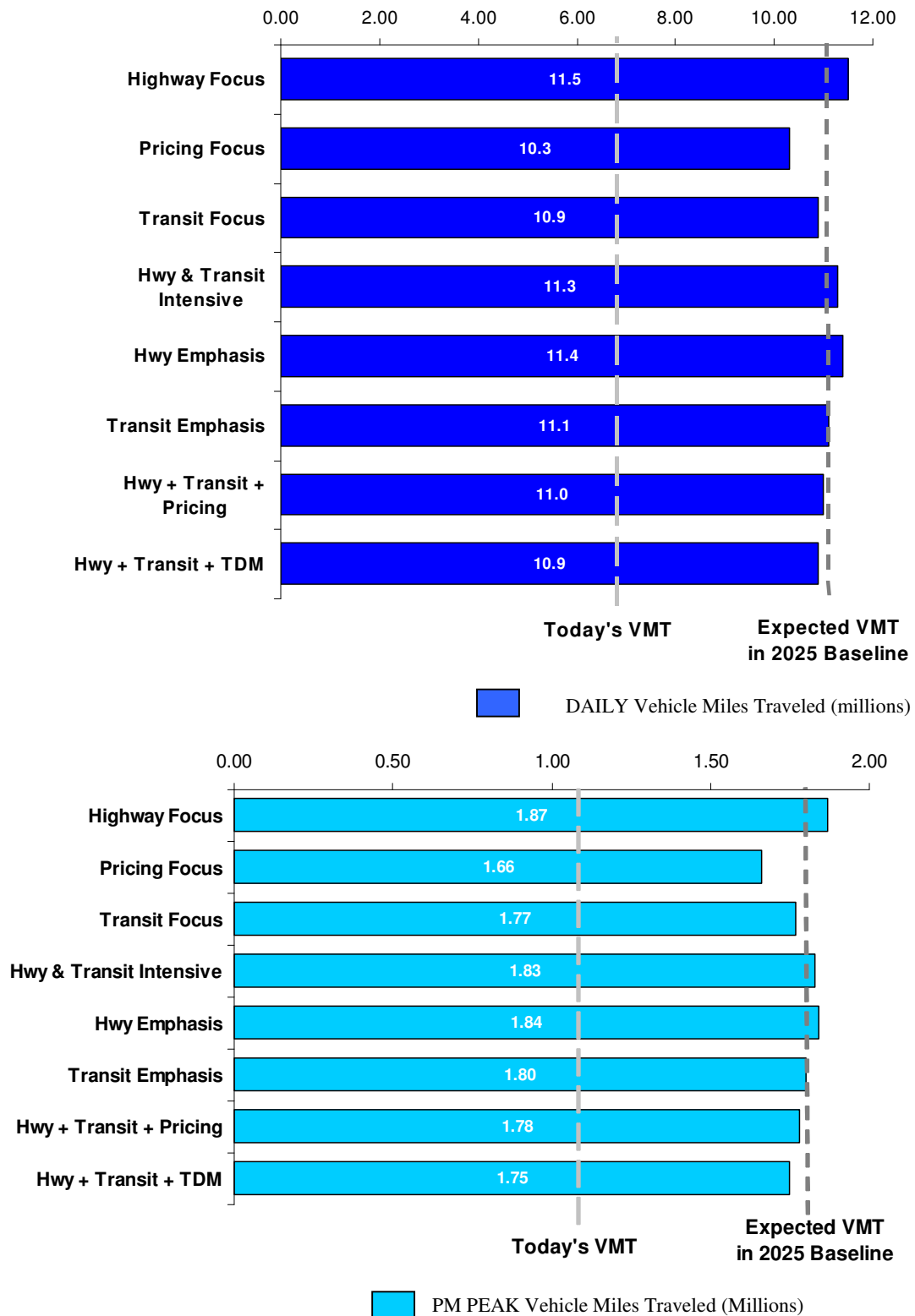
Vehicle Miles Traveled (VMT)

Vehicle miles of travel (VMT) are a measure of total vehicle trips per day multiplied by the length of the trip (in miles). VMT was summarized at the regional level and portrays overall changes in travel activity that may occur in each scenario.

Figure 3-29 summarizes the changes in regional VMT during the daily and PM peak period conditions. Within the region, VMT is estimated to increase 70% in the 2025 Baseline Scenario comparing to the existing condition.

The daily and peak-period VMT remain similar among the scenarios. This is not surprising, given the assumption of the same regional growth forecasts. The Pricing Focus Scenario shows a small decrease in VMT (approximately 6%) due to travel behavior changes: a shift to shorter trips, an increase mode share of carpools and transit, and a reduction in cross-Columbia River trips.

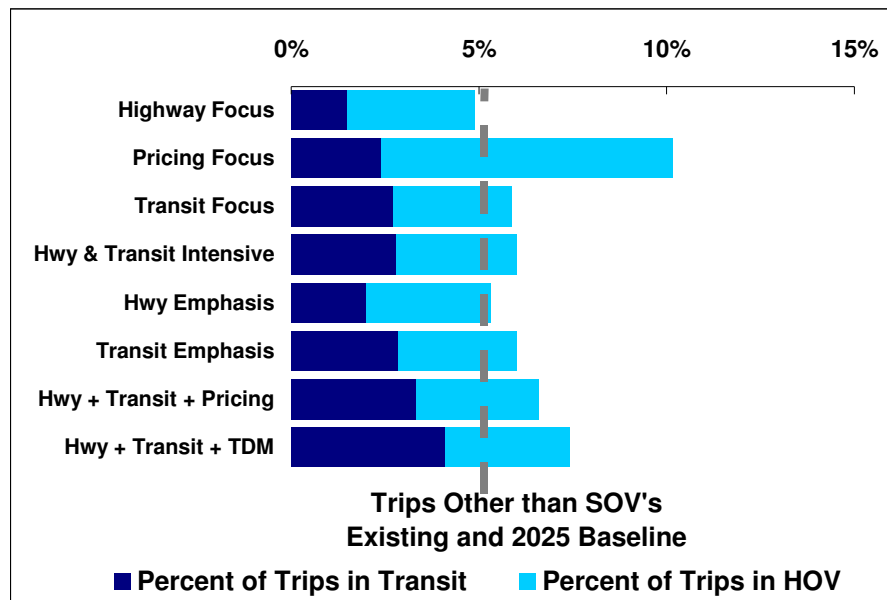
Figure 3-29: Modeled Vehicle Miles Traveled



Mode Share

The mode shares of daily and PM peak period trips of different scenarios are compared. The daily transit mode share would be relatively unchanged, from 1.0% in existing conditions to 0.9% in the 2025 Baseline Scenario. This is due to the transit system remaining relatively static between today and the 2025 Baseline Scenario, while growth continues to occur in outlying areas without transit service. Figure 3-30 shows the transit mode share by scenario.

Figure 3-30: Transit Mode Shares



This criterion showed moderate differences among the scenarios. The results showed an increase in daily and peak-period transit mode share from 0.9% in the 2025 Baseline to 1.5% in the mixed scenarios with a transit emphasis. The transit mode shares would remain relatively constant for the Highway Focus and the Highway Emphasis Mixed Scenario.

The only scenario with carpooling mode share change is the Pricing Focus Scenario, of which carpool mode share doubles. That might be due to the facts that transit does not serve the outlying areas in the Pricing Focus Scenario and carpooling becomes attractive in reducing the per-trip expense.

The Effects of Pricing on Transit Usage

Although the RTC travel demand model is good at capturing the trip redistribution (shortening) effects of pricing, one of its limitations is that it does not capture how some drivers may alter their time of travel and/or eliminate some trips altogether in order to lower travel costs. By underestimating trip time shifting and trip elimination, the model may overestimate the trip redistribution effects of pricing, which tends to counteract any tendency for mode shift to transit. In effect, the model predicts that pricing will cause trips throughout the region to shorten in length, which results in more short local trips that are difficult to serve with transit and fewer long distance trips between regional centers that are well served by transit. The trip distribution effects are substantial with ubiquitous pricing, and the net effect predicted by the model is essentially no significant change in transit mode share, though the rate of carpooling is appreciably higher. Although the development of special model procedures for handling time shifting and trip elimination were beyond the scope of this study, such procedures would likely improve the model's ability to estimate transit mode share changes in response to roadway pricing. Although the modeling results did not indicate an increase in the transit mode share due to congestion pricing, experience from a few parts of the world where some form of area-wide congestion pricing has been implemented suggests that transit ridership and mode share would in fact increase. One example is London, which implemented area-wide congestion pricing in the central part of the city in February, 2003. The city charges a fee of £5.00 (approximately \$8.50) for driving private automobiles in its central area during weekdays between 7:00 AM

and 6:30 PM as a way to reduce traffic congestion and raise revenues to fund transportation improvements. Initial results suggest that the auto use during congestion charge times has dropped by nearly 20% (a reduction of about 20,000 vehicles per day), resulting in the auto mode share declining from about 12% to 10%. The majority of drivers changing their travel patterns due to the congestion charge transferred to public transit. Bus ridership increased by 14% and subway ridership by about 1%. The City of Singapore also has a similar area-wide pricing scheme which was implemented in 1975 and made fully electronic in 1999. Over time, the automobile mode share for trips to the central area has fallen from 56% to only 23%, with most people shifting to transit or carpooling. In the Vancouver area, the overall mode shift would likely be markedly less than observed in Singapore or even London for several reasons. First, these two examples are rather steeply priced "cordon" tolls, while our analysis assumes per-mile tolls that vary with the level of congestion. In addition, the Pricing Focus Scenario assumes variable time-of-day pricing of all trips, at all times, within a four-country region. The other examples focused on weekday, predominantly work trips, into or out of a downtown area. It should also be pointed out that central London and Singapore already have high levels of transit service, making transit a better substitute for a personal auto than would likely be the case over Clark County when considering all types of trips. There may be a more marked mode shift if tolls were location-specific, such as on the Columbia River crossings.

Columbia River Crossings

The I-5 and I-205 bridges that are the only links between Vancouver and Portland serve as critical commute, freight, and non-work trip linkages between Washington and Oregon. The number of vehicles and person trips crossing the Columbia River, and vehicle delay and commercial vehicle delay are important measures to indicate the traffic congestion in the Vancouver/Portland area. Table 3-11 summarizes the cross-Columbia River highway and transit capacity provided in each scenario.

Table 3-11 Cross-Columbia River Capacity by Different Scenarios

Alternative	Highway Lanes	Transit System
Existing	14	Existing bus service level
2025 Baseline	14	Existing bus service level
Highway Focus	24	Existing bus service level
Transit Focus	14	High Capacity Transit
Pricing Focus	14	Existing bus service level
Mixed: Highway and Transit Intensive	20	High Capacity Transit
Mixed: Highway Emphasis	20	Increased bus service
Mixed: Transit Emphasis Scenarios	18	High Capacity Transit

It is noticed that the provision of cross-river capacity (both highway and transit) is directly correlated to cross-river demand: the more highway or transit capacity provided, the higher the number of cross-river person trips.

The results contained in this section are summarized in the following figures. Figure 3-31 shows vehicle trips across the Columbia. Figure 3-32 shows the transit mode share. Figure 3-33 shows person hours of delay across the river.

Highway Focus vs. 2025 Baseline

The number of total person trips and vehicle trips crossing the river increases by 16% compared to the 2025 Baseline. Doubling the number of lanes across the Columbia River results in decreasing the total delay in both person-hours and commercial vehicle-hours by 25-35% on I-5 and by almost 90% on I-205 compared to Baseline. The added capacity on I-5 serves to attract trips from I-205, which contributes to the significant congestion reduction on I-205.

Transit Focus vs. 2025 Baseline

The Transit Focus Scenario is projected to have a moderate effect in reducing overall travel delay relative to the 2025 Baseline Scenario. The number of vehicle trips decreases by approximately 11,000, or 3%, reflecting that some trips would divert from autos to transit. This trip diversion would reduce delay on I-5 by approximately 10% for all vehicle trips and by 30% for commercial vehicle trips, while for I-205 the delay would be reduced by 25% for all vehicle trips and 15% for commercial vehicle trips.

Pricing Focus vs. 2025 Baseline

The model predicted that introducing congestion tolling would reduce I-5 and I-205 river crossings to below the 2025 Baseline level. Value pricing would discourage long distance travel and would result in a higher percentage of trips remaining within Clark County.

Mixed Mode: Highway and Transit Intensive vs. 2025 Baseline

According to the model, the Highway and Transit Intensive Mixed-Mode Scenario would enable approximately 66,000 more person trips, or 20%, to cross the Columbia River compared to the 2025 Baseline. The number of carpool trips would decrease slightly (approximately 1,600) accompanied by about 22,000 transit riders per day. Delay would be reduced by almost 25% for all vehicle trips on I-5 and almost 90% on I-205, while commercial vehicle delay would be reduced by 30% on I-5 and by almost 90% on I-205.

Mixed Mode: Highway Emphasis vs. Transit Emphasis

Generally, the Highway Emphasis Scenario would serve more people at selected screen locations than the Transit Emphasis Scenario. At the river crossing, the number of vehicle trips under the Transit Emphasis Scenario is projected to be approximately 17,000 less than that under the Highway Emphasis Scenario.

Mixed: Pricing and TDM Sensitivity Analyses

Freeway value pricing and expanding the region's Transportation Demand Management efforts in community centers serves to shift trips single-occupant automobiles into carpooling and transit. This in turn reduces congestion on I-5 and on I-205 in both sensitivity analyses compared to the Transit Emphasis Scenario. Overall person trip delays in the Pricing sensitivity analysis on I-5 and on I-205 are slightly higher than for the Highway and Transit Intensive Scenario.

Figure 3-31: Daily Vehicle Volumes Across the Columbia River

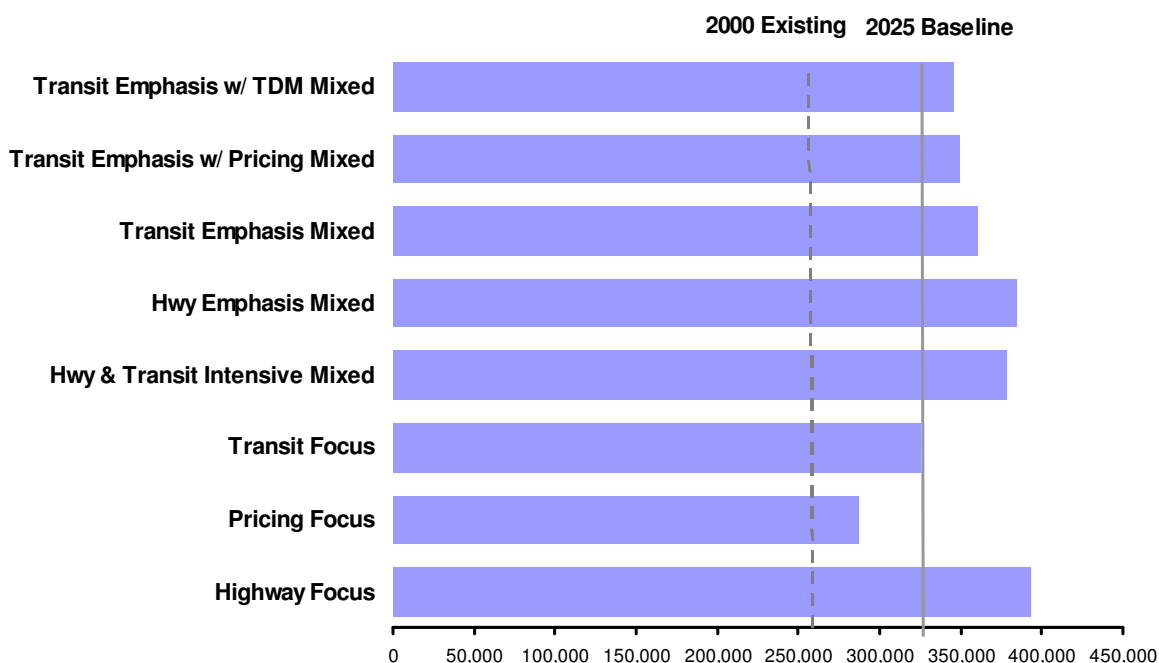


Figure 3-32: Transit Mode Share Across the Columbia River

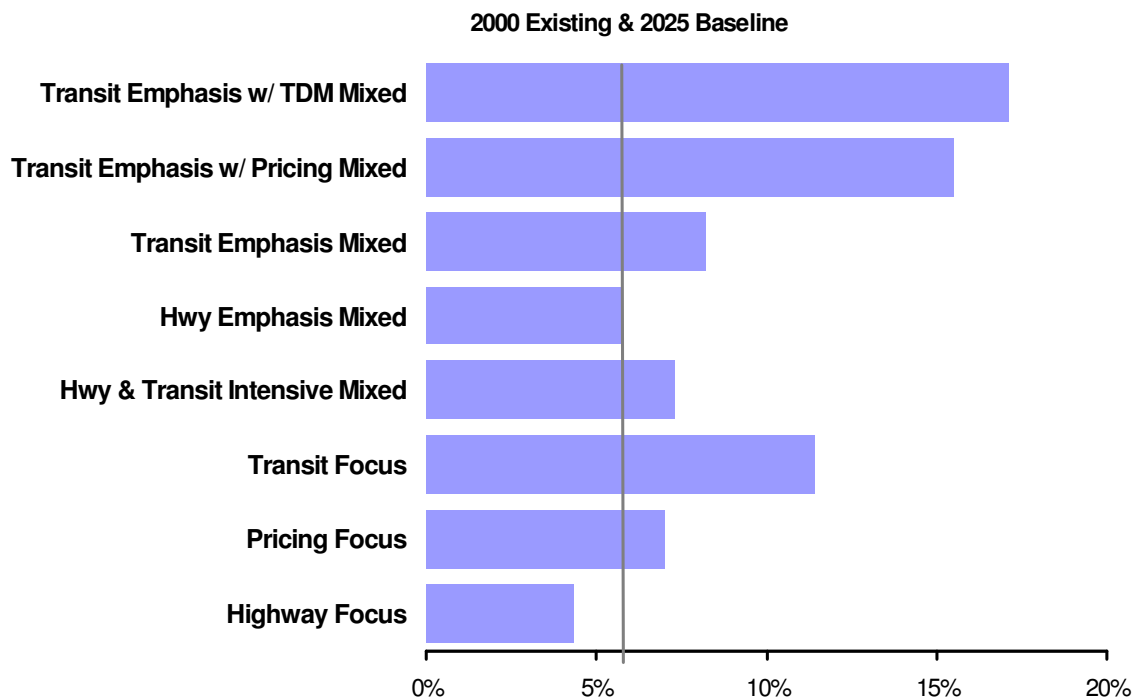
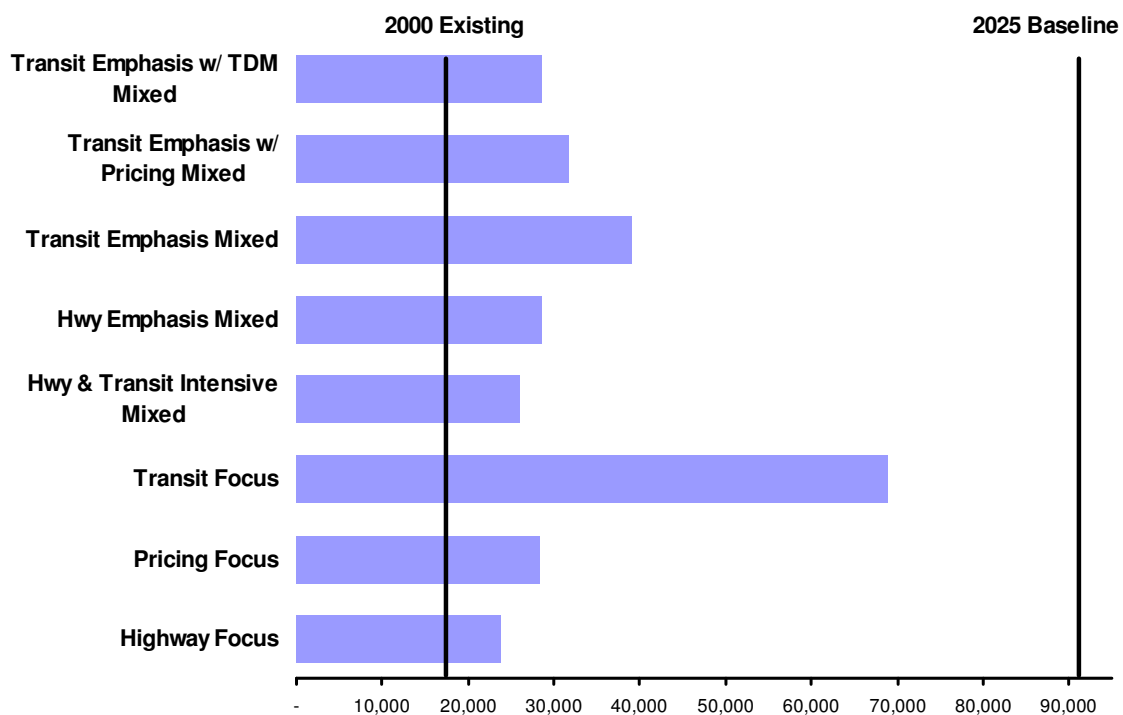


Figure 3-33: Person Hours of Delay across the Columbia River



3.7 Cost Estimates

This section summarizes the cost estimates for the seven scenarios. Costs are provided for both the Clark County/Vancouver and Portland areas unless stated otherwise, though emphasis is placed on the Clark County/Vancouver.

The cost estimates focused on the public costs for implementing, mitigating, operating, and maintaining the infrastructure investments for each scenario. Separate calculations were made for the following cost elements:

Capital costs, including:

- **Design and construction:** Design and construction cost estimates were developed using models based on unit price estimates for 'typical' roadway sections, interchanges, and transit elements for light rail transit, bus rapid transit, commuter rail, buses, and Park-and-Ride lots. Models of interchange, roadway, and transit elements were developed and modified with input from WSDOT and local transit agencies to reflect area case histories. These cost models were applied to the highway and transit improvements on a segment-by-segment basis to compute the design and construction cost estimates.
- **Right-of-way / property takings:** The cost to acquire additional rights-of-way was added to the capital costs. It was calculated based on the sizes and uses of the land. A CAD/GIS system was used to categorize right-of-way acquisition by land use (residential, commercial, industrial). For the highway and transit mixed scenarios, the HCT was added to the highway widening to assess right-of-way needs and impacts.
- **Roadway environmental impact mitigation:** Environmental impact mitigation was added to the capital cost estimate as a percentage of the cost, plus the cost for potential noise mitigation.

Operations and maintenance costs: The annual operations and maintenance (O&M) cost estimates were developed to reflect yearly expenditures by region, including an annual factor for more infrequent but recurring renewal and rehabilitation costs.

Capital Costs

The estimation of capital cost account for error and uncertainty. Capital costs are expressed in constant 2003 dollars. The procedures used for establishing the cost are consistent with the WSDOT Cost Estimation and Validation Process (CEVP). 95 -125% of the calculated cost of highway and transit infrastructure and associated elements are presented to show the range of capital cost estimation. In addition, a wider range on the high side (+30% to +50%) was applied to the toll collection capital investment costs. These differing assumptions reflect a higher degree of uncertainty in the toll collection-related cost estimates and the relatively rapid pace by which toll collection technology changes. Workshops were held with WSDOT, ODOT, C-TRAN, and Tri-Met staff to identify conceptual alignments and design elements for the cost estimation process. These were then combined with cross-sections, unit costs, and contingencies based on WSDOT's CEVP process to yield the capital cost expected value estimates, categorized by Clark County/Vancouver and Portland. Costs for bridge structures, tunnels, retaining walls, noise walls, and major bridges were also included in the cost estimation.

Toll Collection Equipment and Facilities

The toll collection equipment and facilities costs for the two scenarios with value pricing represent two exceptions to cost estimation process. Portions of the toll collection O&M costs were assigned the same -5% to +25% range as capital costs due to uncertainty in future tolling technology. In addition, a somewhat wider range on the high side (+30 to +50%) was applied to toll collection capital costs. These differing assumptions reflect a somewhat higher degree of uncertainty in developing toll collection-related cost estimates, particularly given the relatively rapid pace at which toll collection technology changes.

Table 3-12 provides the overall capital cost ranges for the seven scenarios for Clark County, Washington only. With the exception of the Pricing Focus Scenario, the capital investments examined in this study would be in the billions of constant 2003 dollars. This is because the Pricing Focus Scenario which imposes dynamic value pricing on the 2025 Baseline network using global positioning system and cellular data transmission technologies would not involve major roadway infrastructure investment. As for the Transit Emphasis with Pricing Mixed Scenario, conventional electronic toll collection technologies are assumed in this case (vehicle transponders and in-road transponder readers). The costs of this value pricing approach would be in the hundred million dollar range, rather than billions of dollars.

Table 3-12 Estimated Capital Cost Ranges by Scenario – Clark County Only

Scenario	Capital Implementation Costs in Constant Dollars*		
	Low End of Range	Expected Value	High End of Range
Highway Focus	\$3.1 B	\$3.3 B	\$4.1 B
Transit Focus	\$1.9 B	\$2.0 B	\$2.5 B
Pricing Focus	\$0.3 B	\$0.3 B	\$0.5 B
Hwy & Transit Intensive Mixed	\$4.0 B	\$4.2 B	\$5.2 B
Highway Emphasis Mixed	\$2.3 B	\$2.4 B	\$3.0 B
Transit Emphasis Mixed	\$3.2 B	\$3.3 B	\$4.2 B
Transit Emphasis w/ Pricing Mixed	\$3.3 B	\$3.4 B	\$4.3 B

*Billions of year-end 2003 dollars before present value discounting

Figure 3-34 depicts the capital cost expected values for each scenario segmented by investment type. The mixed scenarios emphasize different combinations of highway and transit investments. The mixed scenario that emphasizes highways has comparatively small transit investment (about 4% of the highway investment amount), while the mixed scenario that emphasizes transit improvements contains a substantial level of highway investments valued at more than 80% of the total cost for the transit improvements.

Figure 3-34: Capital Cost Expected Values by Investment Type (2003 \$ in Billions)

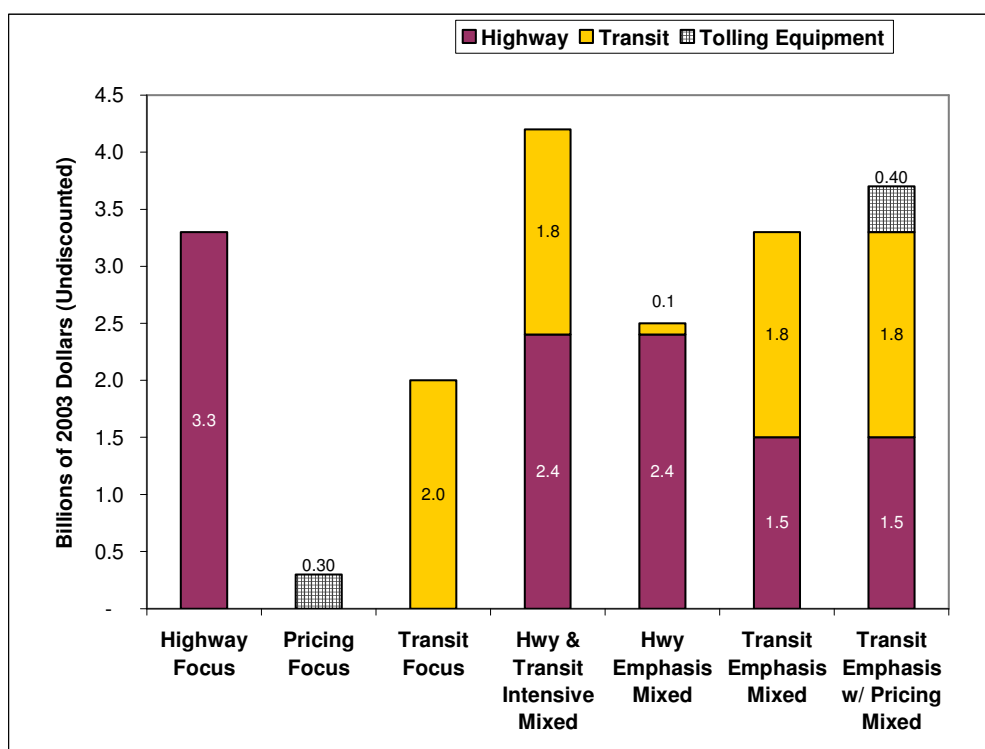


Table 3-13 presents the capital cost ranges for both the Portland and Vancouver regions by each of the seven scenarios, categorized as either highway or transit investments (with toll collection equipment grouped into the highway category).

Table 3-13 Capital Costs for Clark County and Portland Region by Scenario (2003 \$ in Billions)

Scenario	Portland, Oregon		Clark County, Washington		Combined Regions		
	Highway	Transit	Highway	Transit	Highway	Transit	TOTAL
Highway Focus	\$6.4–8.5B	—	\$3.1–4.1B	—	\$9.5–13.6B	—	\$9.5–13.6B
Transit Focus	—	\$0.1B	—	\$1.8–2.4B	—	\$1.9–2.5B	\$1.9–2.5B
Pricing Focus	N/A		\$0.33B		\$0.33B		\$0.33B
Mixed–Highway and Transit Intensive	\$5.7–7.5B	\$0.1B	\$2.3–2.9B	\$1.7–2.3B	\$8.0–10.4B	\$1.8–2.4B	\$9.8–12.8B
Mixed–Highway Emphasis	\$5.7–7.5B	\$0.1B	\$2.3–2.9B	\$0.1B	\$8.0–10.4B	\$0.2B	\$8.2–10.6B
Mixed–Transit Emphasis	\$2.1–2.7B	\$0.1B	\$1.4–1.9B	\$1.7–2.3B	\$3.5–4.6B	\$1.8–2.4B	\$5.3–8.0B
Mixed–Transit Emphasis with Pricing	\$2.2–2.8B	\$0.1B	\$1.5–2.0B	\$1.7–2.3B	\$3.7–4.8B	\$1.8–2.4B	\$5.5–7.2B

All scenarios except the Transit and Pricing Focus Scenarios have substantial right-of-way acquisition and property impacts. The Transit Focus has a moderate level of right-of-way acquisition. The Mixed Scenario – Highway and Transit Intensive has the highest amount of right-of-way needs and residential impacts, with a potential of over 500 acres; about 800 residences and over 200 businesses could be impacted. Many of the right-of-way acquisitions would occur along I-5, I-205, and SR 500.

The Mixed Scenario with Transit Emphasis would involve widening I-5 and I-205 south of 78th Street/Padden Parkway. For those sections the widening is combined with the high capacity transit facility construction, right-of-way acquisition would be reduced to 450 acres, with approximately 550 residences and 150 businesses.

The Highway Focus Scenario has an estimated 300 acres of right-of-way acquisition. For the Transit Focus, the right-of-way acquisition is estimated to be less than that of the mixed scenarios because no highway expansion is involved.

All scenarios except the Transit and Pricing Focus Scenarios have substantial environmental impacts due to added impervious surfaces. The Transit Focus will have a moderate environmental impact. Greatest impacts are associated with roadway-related improvements or where highway and high capacity transit improvements are combined. Transit alternatives will not add substantial impervious surfaces except for maintenance facilities or exclusive bus ways. In comparison to highway strategies, transit strategies have smaller environmental impacts. Due to lack of design details, corridor level wetland and stream impacts were not estimated.

Operations and Maintenance Costs

Annual operations and maintenance (O&M) costs for the new facilities contemplated in the scenarios for Clark County are shown in Table 3-14 and Figure 3-35. Note that highway O&M costs include relatively infrequent renewal costs such as pavement rehabilitation.

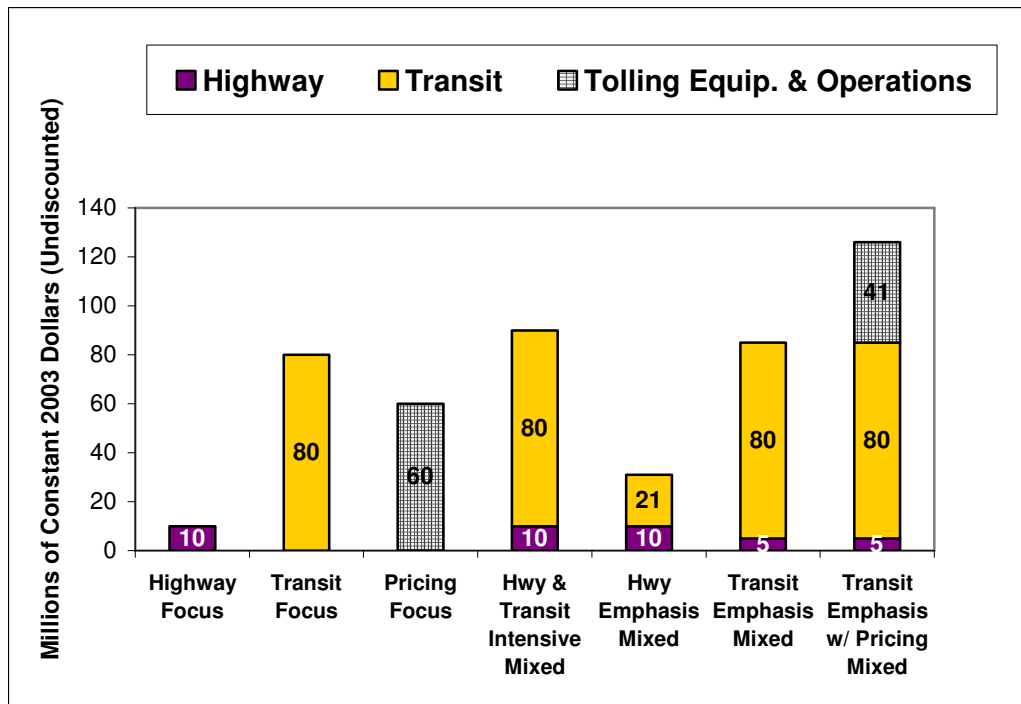
Table 3-14 Annual O&M Costs by Application/Investment Type (2003 \$ in Millions)

Scenario	Portland, Oregon		Clark County, Washington		Combined Regions		
	Highway	Transit ¹	Highway	Transit	Highway	Transit	TOTAL
Highway Focus	\$10 M	—	\$10 M	—	\$20 M	—	\$20 M
Transit Focus	—	—	—	\$80 M	—	\$80 M	\$80 M
Pricing Focus ²	N/A	—	\$60 M	—	\$60 M	—	\$60 M
Mixed–Highway and Transit Intensive	\$10 M	—	\$10 M	\$80 M	\$20 M	\$80 M	\$100 M
Mixed–Highway Emphasis	\$10 M	—	\$10 M	\$11 M	\$20 M	\$11 M	\$31 M
Mixed–Transit Emphasis	\$5 M	—	\$5 M	\$80 M	\$10 M	\$80 M	\$90 M
Mixed–Transit Emphasis with Pricing	\$5 M	—	\$46 M	\$80 M	\$51 M	\$80 M	\$131 M

1 For the purposes of this study, all transit O&M costs were allocated to Vancouver/Clark County on the Washington side of the river.

2 The amount of transit ridership resulting from the travel demand modeling of the Pricing Focus Scenario would likely require an additional amount of transit service to support the increased demand.

Figure 3-35: Annual O&M Costs by Investment Type – Clark County (2003 \$ in Millions)



3.8 Economic Analysis

An economic analysis of the various focus and mixed scenarios was conducted to assess each scenario's incremental benefits and costs relative to the 2025 Baseline Scenario. A combination of user and societal mobility benefits were assessed for the Year 2025, as were the operations and maintenance costs for the new investments. The benefits and costs measured were limited to those accruing within Clark County, Washington for purposes of the economic benefit-cost analysis. The RTC model network and zone system becomes less detailed outside of Clark County. The lack of network detail on Portland side renders benefit estimate less meaningful.

Capital costs were assessed over a construction period proportional to the total investment size, and then annualized by estimating their 1-year equivalent lease payment. For comparison purpose, all benefits and costs occurring at future points in time were expressed in constant 2003 dollars.

A more detailed discussion of the economic benefit-cost analysis methodology can be found in Chapter 1 and in the *Benefit-Cost Analysis Methodology Technical Memorandum* (Parsons Brinckerhoff, November 2004) included as Appendix A.

Cost Accounting

According to standard benefit-cost analysis practice, costs are defined as the public costs for implementing, mitigating, operating and maintaining the infrastructure investments associated with each scenario, relative to the 2025 Baseline Scenario. Any other costs (i.e., those borne by travelers) are considered in the assessment of benefits as disbenefits or negative benefits. For example, an increase in user travel costs is measured as a deduction to the benefits that user receives rather than as an increase to the infrastructure costs.

Capital investment costs are expressed as estimated ranges in constant 2003 dollars, as summarized in the previous section. These cost ranges were then annualized — converted to their equivalent annual lease payments — to facilitate combining them with annual O&M costs for direct comparison with annual benefits in 2025. Annual operations and maintenance (O&M) costs reflect yearly expenditures for 2025 and include an annual factor for more infrequent but recurring renewal costs, but were not assigned ranges.

Why was the assessment of benefits and costs limited to Clark County?

Under ideal conditions, total benefits throughout the study area would be measured and compared with total costs on both sides of the river. This was the original intention and approach for the economic benefit-cost analysis. However, the RTC travel demand model used in this study employs traffic analysis zones at a relatively high level of aggregation on the Oregon side of the river. The size of these zones, combined with less network detail, significantly constrained the ability to analyze the full range of changes in travel behavior expected under the various scenarios, and thus, reasonably calculate total mobility benefits in Oregon.

After considerable debate, the benefit-cost analysis was restricted to Clark County only. However, this Washington-only approach is also problematic in that certain investments in Washington may contribute to the benefits accruing in Oregon and vice versa.

At first glance, there is no reason to believe that the benefit-generating productivity of the Oregon investments at a programmatic or system level would be significantly different than similar investments in Washington.

However, the nature of the investments considered in Oregon, and the more densely developed environment in which they would be implemented, may indicate that they would be less productive at reducing congestion per unit of capital investment than the Washington investments. In this case, the consideration of overall benefits and costs may lead to lower overall levels of economic feasibility than realized for Clark County alone.

In the absence of a modeling framework that provides detailed data for both the Vancouver and Portland areas, a truly comprehensive assessment of benefits and costs was not possible.

Table 3-15 shows the estimated values within the range, their associated annualized amounts or equivalent annual lease payments, and the annual O&M costs. All values are in constant 2003 dollars before present value discounting.

Table 3-15 Capital Cost Total and Annualized Expected Values and Annual O&M Costs

Scenario	Capital Implementation Costs in Constant Dollars		
	Total Expected Value (Range "Midpoint")	Annualized Value (Equivalent Lease Payment)	Annual O&M Costs
Highway Focus	\$3.3 B	\$151 M	\$10 M
Transit Focus	\$2.0 B	\$112 M	\$80 M
Pricing Focus	\$0.33 B	\$25 M	\$60 M
Hwy & Transit Intensive Mixed	\$4.2 B	\$213 M	\$90 M
Highway Emphasis Mixed	\$2.4 B	\$112 M	\$21 M
Transit Emphasis Mixed	\$3.3 B	\$174 M	\$85 M
Transit Emphasis w/ Pricing Mixed	\$3.4 B	\$180 M	\$131 M
* Billions of year-end 2003 dollars before present value discounting			

Benefit Accounting

The economic analysis evaluated mobility benefits for the 2025 analysis year, divided into two main categories:

User benefits

- Personal travel benefits expressed as the dollar value of travel time and out-of-pocket cost savings by autos and transit users; and
- Commercial travel benefits expressed as the dollar value of travel time and operating expense savings.

Societal benefits

- Economic benefits of improved safety/accident reduction, and the associated avoidance of fatality, injury, and property losses;
- The associated mobility benefits of reducing non-recurrent incident congestion delay; and
- Reductions in auto ownership costs resulting from scenarios that reduce overall auto use.

User benefits are so grouped because they reflect benefits accruing directly to system users of all

Benefits Range

Similar to the capital cost estimates, a range was applied to the total estimated benefits to account for some of the uncertainty and measurement error in assessing and valuing benefits. In this case, a symmetrical range of +/- 20% about the expected benefit amounts was applied to each scenario. The percentage range used reflects the majority opinion of the study's expert panel.

User Benefits or User Costs?

Travelers tend to consider their own "costs" in making travel decisions. User costs represent travel time and those monetary "out-of-pocket" costs considered in making an individual trip (e.g., gas and oil, transit fares and tolls, but not fixed costs such as insurance or license fees). A reduction in these user costs produced by one of the analysis scenarios results in user benefits relative to the 2025 Baseline. Travel time savings tend to be the primary component of user benefits. However, it is possible for a scenario to increase overall user costs, at least for some users. Any increases in user costs were treated as deductions to the benefits (disbenefits) rather than as increases to the scenario cost components — the construction and O&M costs of a scenario's investments.

modes, and they represent the majority of the benefits quantified. Societal benefits capture the more indirect mobility benefits accruing to all of society, including benefits to non-users. Societal benefits are driven off changes in overall vehicle miles traveled (VMT). Overall changes in VMT per vehicle affects annual depreciation costs in the case of auto ownership, while relative changes in VMT between facilities with different accident rates affect safety benefits/accident loss costs. Either case could result in benefits or disbenefits, relative to the 2025 Baseline, depending on the impacts of each scenario.

Some benefits/disbenefits do not have monetary quantification within the framework of this study. Examples include the long-term health-related value of changes in vehicle emission levels and concentrations, and the effect of business location decisions on regional employment and economic activity that is affected by traffic congestion. A thorough discussion of the benefits can be found in Appendix A.

Economic Analysis Metrics

The total annual benefit and cost ranges, expressed in discounted present values, represent two key metrics. Additional metrics were developed to express and compare various subsets of the benefits on a per trip basis. These metrics illustrate how certain benefits are distributed (before present value discounting). Finally, a metric that indicates the total annual person hours of auto delay savings per \$1 million of total capital investment was prepared. The following sections present the results for each of these economic analysis metrics.

Metric: Benefit and Cost Present Value Ranges

To appropriately make comparisons between the monetary benefits and costs of each scenario relative to the 2025 Baseline, it is necessary to consider these amounts as discounted present values. Because future benefits and costs were already estimated in current dollars, a real discount rate of 3.5% (excludes an inflation component) was used to value future benefits and costs in present worth terms. Additional discussion of present value discounting is included in the Methodology section of Chapter 1 of this report and in Appendix A.

Table 3-16 presents the expected benefit and cost values as well as their range low- and high-endpoints, for Clark County.

Table 3-16 Low, High and Expected Annual Values for Benefit and Costs in Clark County

Scenario	Discounted Present Values					
	2025 Annual Benefits Range			Annualized Capital + O&M Costs Range		
	Low End	Expected Value	High End	Low End	Expected Value	High End
Highway Focus	\$54 M	\$67 M	\$80 M	\$77 M	\$81 M	\$100 M
Transit Focus	\$34 M	\$43 M	\$52 M	\$91 M	\$94 M	\$108 M
Pricing Focus	\$113 M	\$142 M	\$170 M	\$39 M	\$41 M	\$50 M
Hwy & Transit Intensive Mixed	\$76 M	\$95 M	\$114 M	\$144 M	\$149 M	\$176 M
Highway Emphasis Mixed	\$64 M	\$80 M	\$96 M	\$64 M	\$66 M	\$80 M
Transit Emphasis Mixed	\$61 M	\$76 M	\$91 M	\$123 M	\$127 M	\$149 M
Transit Emphasis w/ Pricing Mixed	\$148 M	\$185 M	\$221 M	\$147 M	\$152 M	\$179 M
Note: Benefits and costs are expressed as ranges around future expected values, expressed in constant 2003 dollars inclusive of present value discounting. Benefits exclude non-quantifiable congestion relief impacts, including the effects on business location decisions and economic activity.						

Figure 3-36 presents the annualized cost range for each scenario from the Clark County perspective. Figure 3-37 presents the 2025 annual benefits range for each scenario.

Figure 3-36: Annualized Cost Ranges in Discounted Present Values (Clark County)

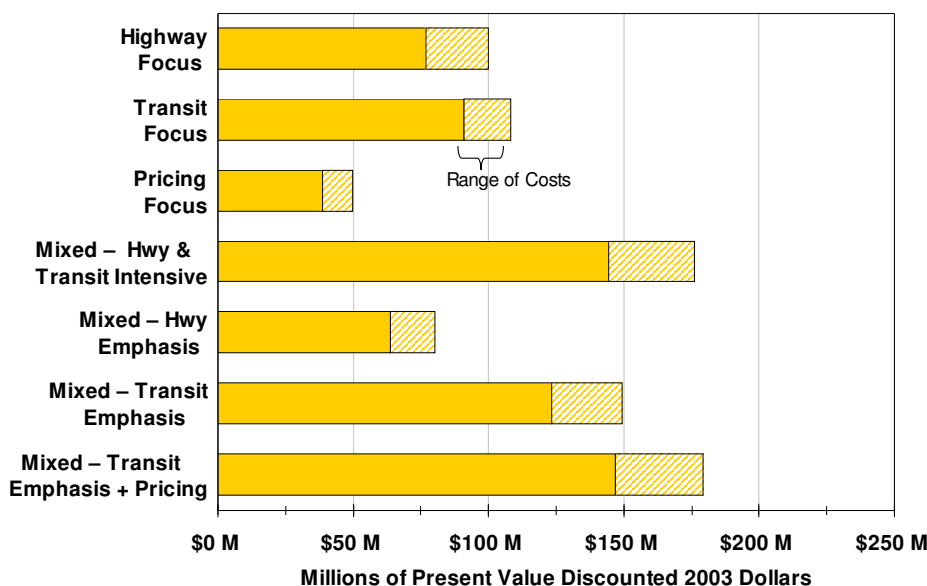
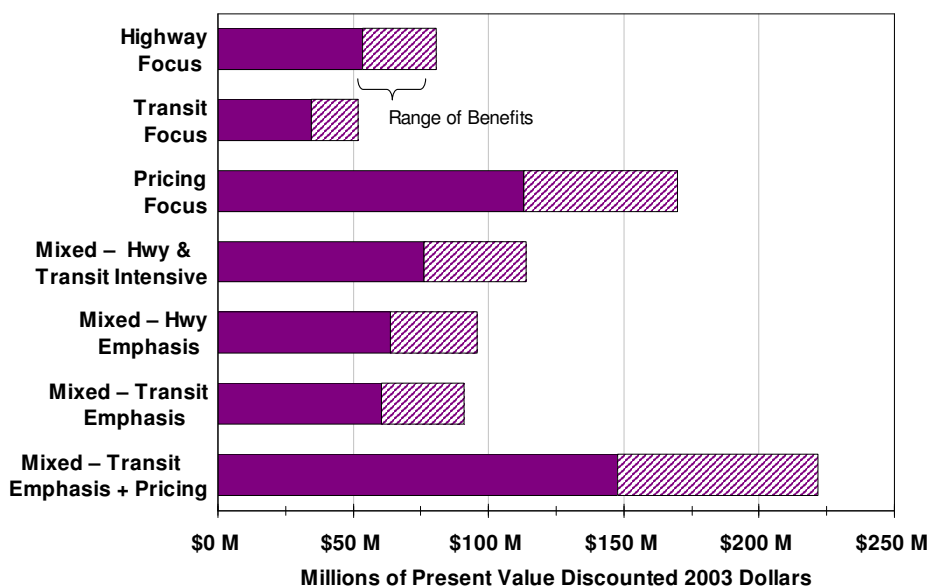


Figure 3-37: Annual Benefit Ranges in Discounted Present Values (Clark County)



Note: Benefits exclude non-quantifiable congestion relief impacts, including the effects on business location decisions and economic activity.

In general, the highway investments evaluated in the study's scenarios tended to generate more benefits per dollar cost than did transit investments. A comparison of Figures 3-36 and 3-37 suggests that none of the scenarios involving major capital investment have economic benefits (measured in travel time savings) that are substantially higher than the associated costs, as evaluated for Clark County. The Pricing Focus Scenario, which does not involve any capacity

improvements, was found to have benefits well in excess of its costs. However, this scenario would likely generate transit demand above what could be served without additional transit service/facilities of which would narrow the gap between benefits and costs.

One needs to be very careful in interpreting the results because not all benefits and cost were accounted. The assessment of benefits focused on the user benefits accruing directly related to the passenger and commercial vehicles using the transportation system. Benefits such as increased overall economic activity, employment gains and net business in-migration resulting from an improved transportation system are difficult to measure, thus these were not included.

Highway and Transit Focus Scenarios

The Highway Focus Scenario generates more benefits per dollar invested than does the Transit Focus Scenario, as evidenced by a comparison of Figures 3-37 and 3-38. With approximately equal annualized costs, the Highway Focus Scenario generated 50% more benefits than did the Transit Focus Scenario.⁵ One challenge of the Transit Focus Scenario is that most of the benefits contribute to a relatively small proportion of travelers. While this scenario generates significant benefits on a per-trip basis (see Table 3-18), the travel demand model predicts that transit users will make up less than 3% of weekday total personal travel. Ongoing costs for transit operations and maintenance are also higher per dollar of capital investment than for highways.

Pricing Focus Scenario

Since its capital investment is limited solely to toll collection and operating equipment, with no capacity improvements, the Pricing Focus Scenario has substantially lower overall annualized costs. This holds true despite its relatively high annual O&M costs associated with the operation, customer service, administration, and enforcement activities associated with value pricing. Roadway tolling reduces congestion through influencing people's travel behavior to make shorter trips, use less congested, lower toll routes, travel in less congested time, and use low cost travel options such as transit and carpools. By removing a small proportion of travel off of congested roadways during times of high demand, roadway tolling enables roadways to operate at a high efficiency and achieve substantial time savings at same time.

This study assumes the toll revenues generated are put to a beneficial public use, but does not proscribe how the available revenues (net of operations costs) would be spent. There are many options for putting toll revenues to beneficial use, It is conceivable that some of the revenues could be used to offset the costs borne by those who alter their travel in response to tolls. For example, the provision of toll credits for those that opt to drive at low demand times of day. Similarly, revenues could potentially be used to finance roadway improvement or pay for alternative modes, such as additional transit service. In fact, the mode shift to transit predicted by the travel demand model suggests that transit demand would substantially exceed capacity, and additionally transit service and/or facilities would be required.

Much of the "delay savings" from value pricing would occur because trips would be shorter (although the reduction in travel would also lower congestion and thus, reduce delay via improved speeds). The problem, however, is that time saved for a shorter trip may not represent the traveler's "first choice" of destination, and thus, should not be fully counted as an economic benefit. The assessment of overall user benefits for the Pricing Focus Scenario takes

⁵ Though their annualized costs are approximately equal, the Transit Focus Scenario involves somewhat lower capital costs but significantly higher operating and maintenance costs than the Highway Focus Scenario.

into account both time saving benefits and the disbenefits associated with changing trip destination.

Mixed Scenario – Highway and Transit Intensive

The modeled results suggest that the “mixed” scenarios could be more cost-beneficial than single-mode investments since they would potentially include the productive components of each modal improvement evaluated in the Focus Scenarios and also take advantages of cross-modal synergies. The Highway and Transit Intensive Scenario sets the ceiling levels of modal investment for the other mixed scenarios. It combines the majority of the investments of the two focused scenarios — 71% of the Highway Focus and 93% of the Transit Focus levels of investment, in terms of dollars of expenditure. Overall, this amounts to 126% of the Highway Focus Scenario expenditures, with 56% of investments allocated to highways and 44% to transit. While the benefits are also higher than either of the two modal-focused scenarios, the particular combination of investments in this mixed scenario would not appear likely to generate benefits in excess of costs within Clark County.

Mixed Scenario – Highway Emphasis

This scenario holds the level of highway investment at 71% of the Highway Focus Scenario, but drops the level of transit investment to only 4% of that of the Transit Focus Scenario. By scaling back the level of highway and transit investments to some of the more congested facilities, the Highway Emphasis Mixed Scenario generates more overall benefits at a lower cost than either the Highway Focus or Transit Focus Scenarios. In fact, this scenario delivers more benefits per dollar of cost than any of the other scenarios without value pricing. Though the spread in the level of transit investments is a bit extreme between the mixed scenarios that emphasize transit and those that don’t, the Highway Emphasis Mixed Scenario suggests that modest transit investments (primarily additional bus service and additions to the fleet) can yield substantial benefits when combined with highway investments that also improve transit vehicle operations.

Mixed Scenario – Transit Emphasis

The Transit Emphasis Mixed Scenario holds the level of transit investment within Clark County at 93% that of the Transit Focus Scenario, while scaling back the level of highway investment to 45% that of the Highway Focus Scenario. The term “transit emphasis” is somewhat relative, as the level of highway investment in this scenario is still 82% that of the transit capital expenditures. Overall, this scenario’s levels of benefits are similar to that of the Highway Emphasis Mixed Scenario, but its annual costs are nearly double.

Mixed Scenario – Transit Emphasis with Pricing

The Transit Emphasis with Pricing Mixed Scenario adds variable freeway tolls to the Transit Emphasis Scenario. Unlike the Pricing Focus Scenario, the extent of value pricing in this Mixed Scenario is limited to the freeway system. Nonetheless, the same caveats still apply. As shown in Figure 3-38, the annual costs are higher than the same scenario without pricing, due to the O&M costs associated with toll collection and administration. However, the delay reduction on the freeway network resulting from tolling raises the level of benefits well above the costs. This scenario demonstrates the potential benefits of synergies of selective value pricing with capacity investments. In this case, value pricing helps to better match demand with available capacity during peak times and improve the operational efficiency of the freeway system. By reducing auto use for some discretionary trips and inducing some travelers to shift into transit or carpools, the addition of value pricing—in combination with capacity improvements—enhances traffic flows and generates tangible delay savings to all system users, including transit.

Metric: User Benefits per Person Trip by Mode/Trip Type

Aside from comparing overall benefits and costs, it is interesting to examine how user benefits generated per trip varies across travel modes and scenarios. This analysis metric considers user benefits only—those changes in travel time and out-of-pocket costs experienced directly by travelers—on a per trip basis. Combined with mode share estimates, this metric helps to illustrate how benefits are distributed.

Table 3-17 summarizes the expected 2025 user benefits per person trip and mode share. The benefits are expressed in constant 2003 dollars based on the expected values (i.e., midpoint of the range) before present value discounting. The Transit Focus Scenario would deliver an average user benefit of \$2.75 per transit person-trip, but transit trips are estimated to comprise only 2.7% of all personal travel. In the same scenario, auto users would enjoy average benefits of only \$0.05 per person-trip, yet comprise the vast majority of all personal travel. As a result, the Transit Focus Scenario would provide composite average benefits of \$0.12 per person-trip (all modes).

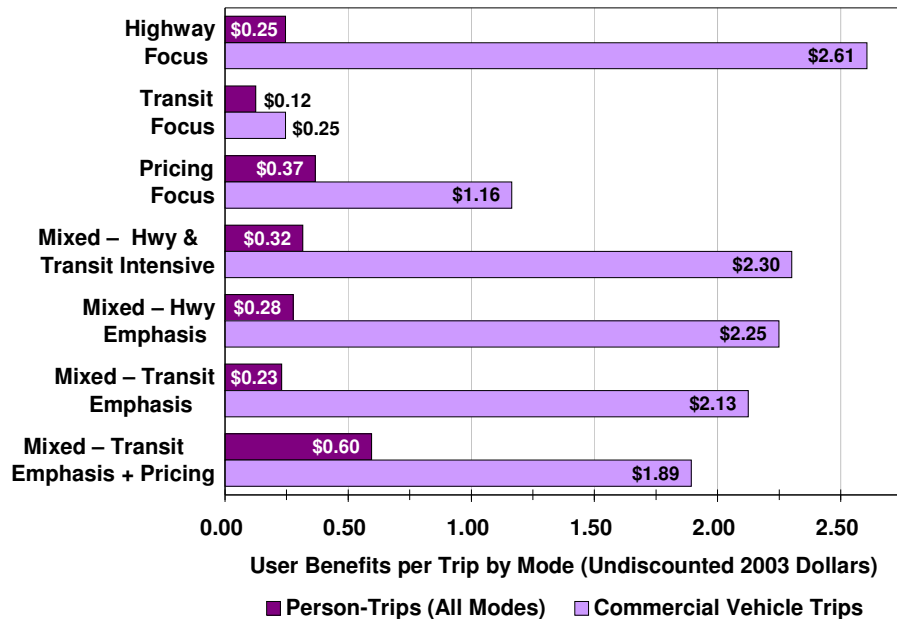
Table 3-17 User Benefits per Person Trip by Mode / Trip Type (Expected Values/Clark County)

Scenario	Personal Travel					Commercial Travel
	Auto		Transit		Total	User Benefits per Vehicle-Trip
	User Benefits per Person-Trip	Mode Share	User Benefits per Person-Trip	Mode Share	User Benefits per Person-Trip	
Highway Focus	\$0.25	98.6%	\$0.02	1.4%	\$0.25	\$2.61
Transit Focus	\$0.05	97.3%	\$2.75	2.7%	\$0.12	\$0.25
Pricing Focus	\$0.38	97.5%	\$0.00	2.5%	\$0.37	\$1.16
Hwy & Transit Intensive Mixed	\$0.25	97.5%	\$2.78	2.5%	\$0.32	\$2.30
Highway Emphasis Mixed	\$0.25	98.2%	\$1.59	1.8%	\$0.28	\$2.25
Transit Emphasis Mixed	\$0.16	96.8%	\$2.81	3.2%	\$0.23	\$2.13
Transit Emphasis w/ Pricing Mixed	\$0.53	96.8%	\$2.56	3.2%	\$0.60	\$1.89

* Year 2025 range midpoint expected values in 2003 dollars before present value discounting for User Benefits only (includes travel time and out-of-pocket cost savings accruing to users and excludes other indirect or societal benefits).

Figure 3-38 depicts the last two columns of data in Table 3-17. This figure compares the composite average user benefits per person-trip for personal travel with the average user benefit per vehicle-trip for commercial travel. The values for each scenario are compared to the 2025 Baseline Scenario. The higher value of time assigned to commercial vehicle trips, combined with a longer average trip distance for commercial vehicles, results in greater benefits per trip in all of the seven scenarios analyzed.

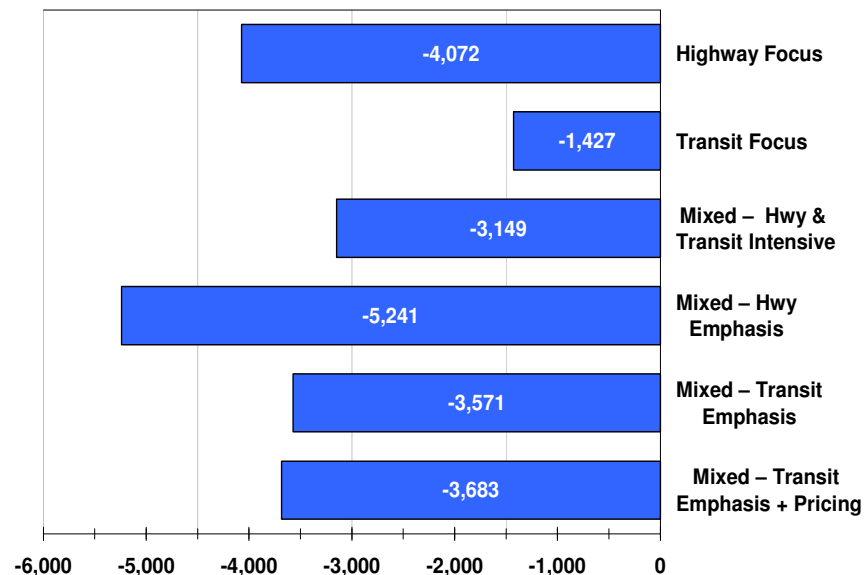
Figure 3-38: User Benefits per Trip by Personal and Commercial Travel (Range Midpoint Values)



Metric: Annual Person-Hours of Delay Savings per \$1 Million Capital Investment

The economic analysis metric compares each scenario's primary benefit of travel time savings to the primary cost of capital investment in Clark County. Figure 3-39 shows the annual person-hours of vehicle delay savings per \$1 million of total capital investment for all the scenarios.

Figure 3-39: Daily Person Hours of Vehicle Delay Savings per \$1 Million Capital Investment



Note that Figure 3-39 omits the Pricing Focus Scenario, in part because the lack of capacity investments under this scenario is predicted to cause a significant shift to transit that could not be supported with 2025 Baseline transit service levels. Without considering the need for additional transit service, the Pricing Focus Scenario would have had the highest delay savings per capital investment due to its relatively small investment level limited to toll collection and enforcement equipment. Had the Pricing Focus Scenario been combined with the transit investments of the Transit Focus Scenario (but only considering the highway delay reduction attributable to value pricing), the Pricing Focus Scenario's value for the metric in Figure 3-39 would have been comparable to that of the Highway Focus Scenario. Note that minimum level of transit investment required to accommodate the Pricing Focus Scenario's transit mode shift was not determined; all that can be concluded is that it is somewhere in-between zero and the \$2 billion mark included in the Transit Focus Scenario.

Funding Considerations and Benefit-Cost Analysis

It is important to view the economic analysis of scenarios as a data analysis exercise constructed to help understand the relationships of costs and benefits in the context of congestion relief. This study did not consider how transit and highway capital investments could be funded, or how the likely potential funding mechanisms may also influence travel demand.

Given the magnitude and scale of the investments analyzed in these scenarios, the taxes or fees sufficient to fund the projects could potentially result in travel demand changes. For example, if a significant portion of the cost were funded by a local tax or fee related to user costs—such as the gas tax—the resulting tax would likely represent a substantial and sustained increase in travel costs, high enough to reduce overall travel demand.⁶ This effect would be similar to tolls. If the generation of revenues to fund improvements actually changed travel patterns and/or lowered overall travel demand, this could ultimately result in the need for a somewhat smaller portfolio of investments at a lower cost. Put another way, some of the scenarios considered may be so extensive that most of the currently conceivable ways for funding their construction could also have the effect of mitigating some of their need. Large-scale actions require careful consideration of their impacts, including a feedback-loop that considers the intertwined effects of how the public pays for and uses their transportation infrastructure, in order to strike the appropriate balance between relieving congestion and facilitating travel.

⁶ For 2015, the horizon year for WSDOT's motor fuel tax revenue forecast, each penny of the current 28¢ state-wide fuel tax is projected to generate \$40 million in revenue. Substantial increases in the gas tax would generate less revenue per penny due to the price elasticity of demand effects — at higher prices, consumption drops.

3.9 Environmental Review

As described in Chapter 1, an environmental review was completed for the various Congestion Relief Analysis scenarios. A summary of this review is included in Table 3-18. The table includes the following potential impacts: right-of-way/property takings, changes to impervious surfaces, wetlands, streams, land use, air quality, noise, and minority and low-income populations. In general, the highway-oriented scenarios would have the highest potential for environmental impacts, while the Pricing Focus Scenario would result in the fewest impacts.

Table 3-18 Environmental Evaluation Matrix – Vancouver

Environmental Performance Criteria	Highway Focus	Transit Focus	Pricing Focus	Highway & Transit Intensive	Highway Emphasis	Transit Emphasis	Transit Emphasis + Pricing	Transit Emphasis + TDM	Comments
Right-of-Way/ Property Acquisitions Residential/ Business Units Impacted	700/200	50/30	0/0	750/260	560/160	540/130	540/130	540/130	All scenarios except Pricing Focus have substantial Right-of-Way and property impacts, the Transit Focus has moderate right-of-way impacts. The greatest impacts are associated with significant highway widening combined with high capacity transit.
Changes to Impervious Surfaces	Significant increase	Minor increase due to separate guideway for HCT and additional Park-and-Ride spaces.	No increase	Significant increase	Significant increase	Minor increase due to separate guideway for HCT and additional Park-and-Ride spaces.	Minor increase due to separate guideway for HCT and additional Park-and-Ride spaces.	Minor increase due to separate guideway for HCT and additional Park-and-Ride spaces.	All scenarios except Pricing Focus have measurable impacts due to added impervious surfaces. The greatest impacts are associated with highway related improvements, followed by those with significant transit improvements due to HCT guideway surface and additional Park-and-Ride/HCT station paving.
Wetlands – Acres Impacted	60	70	0	72	71	70	70	70	All scenarios except Pricing Focus have measurable impacts to wetlands. The greatest impacts are associated with highway related improvements, followed by those with significant transit improvements due to HCT guideway surface and additional Park-and-Ride/HCT station paving occurring on or adjacent to wetlands.
Stream Crossings (Linear Feet)	30,000	19,000	0	34,700	28,600	34,700	34,700	34,700	Stream impacts similar to wetland impacts – associated primarily with highway-related improvements.

Table 3-19 Environmental Evaluation Matrix – Vancouver (continued)

Environmental Performance Criteria	Highway Focus	Transit Focus	Pricing Focus	Highway & Transit Intensive	Highway Emphasis	Transit Emphasis	Transit Emphasis + Pricing	Transit Emphasis + TDM	Comments
Land Use	See text								Major highway widening alternatives would likely increase non-residential development pressure along the I-5 corridor north to the LaCenter and Battle Ground areas, with the greatest increased pressure for residential growth occurring east and north of I-205 outside the UGA
Air Quality	See text								Air quality impacts are associated with highway improvements. Transit improvements and value pricing strategies are anticipated to reduce vehicle trips and therefore reduce air quality impacts.
Noise (Linear Feet of Noise Mitigation)	91,300	20,000	0	57,300	50,000	39,300	39,300	39,300	Noise impacts are primarily associated with highway improvements although steel-wheeled transit vehicles are also anticipated to produce some noise impacts.
Minority and Low-Income Populations (Environmental Justice?)	See Figures 3-40 and 3-41								Highway improvements have more potential for direct impacts due to property acquisition and noise, while transit improvements have more potential for benefit due to increased accessibility but also may experience noise and right-of-way impacts. The value pricing option could disproportionately impact low-income populations.

Air Quality

Air quality impacts were assessed based on outputs from the travel demand forecast model, including link volumes, speeds, and travel distances. Emissions per mile traveled for carbon monoxide (CO), hydrocarbons (HC), and oxides of nitrogen (NO_x) were calculated for each travel link based on the forecast operating speed for the link using the RTC's input files to the Mobile 6.2 emissions model. The number of vehicle miles traveled on each link was multiplied by the emissions per mile of travel for each link. This analysis provides only an estimate of potential emissions that can be compared among the scenarios and is not adequate to meet federal or state conformity requirements for conducting regional emissions analysis.

Air quality impacts are typically associated with highway improvements. Regional transportation air pollutant emissions modeled for 2025 varied somewhat between the various alternatives considered. The differences among the scenarios result from differences in projected travel patterns under the various scenarios.

Transit improvements and value pricing strategies are anticipated to reduce vehicle trips and therefore reduce overall air quality impacts. Depending on the fee or toll collection strategy, there may be location-specific increases in emissions in the Pricing Focus and Mixed – Transit Emphasis with Pricing Scenarios, if manual cash-paying toll collection methods are used.

Under the Transit Focus and all mixed scenarios, some location-specific increases in emissions are expected in the morning peak for vehicles traveling to Park-and-Rides and HCT stations, and in the afternoon for vehicles leaving the Park-and-Rides or stations. These are known as

“cold starts” and reflect the lower emissions control abilities of cold vehicle engines. Additionally, in the PM peak, vehicles will depart in “platoons” as the departures coincide with the arrival, and deboarding, of buses or HCT vehicles at Park-and-Rides and stations. However, these added emissions are more than offset by the shift from single-occupant vehicles into carpools and transit under all of these scenarios.

Vancouver region air pollutant emissions are shown in Table 3-20. The mixed scenarios would be expected to have fewer impacts than the Focus Scenarios but more impacts than the 2025 Baseline, particularly the Highway/Transit Intensive and Highway Emphasis Scenarios. Increasing the level of transit improvements is expected to decrease the air quality impacts. Emissions would be highest under the highway focus because vehicle miles traveled would be substantially greater under that alternative than for the other alternatives. The Highway Focus shows an increase in CO emission levels by approximately 2% over the 2025 Baseline Scenario. The Pricing Focus shows a decrease of approximately 4% in CO emissions over the 2025 Baseline. The Transit Focus shows a decrease of approximately 3% in CO emissions over the 2025 Baseline. HC and NO_x levels range between a 2% increase and a 5% decrease for the focus scenarios compared to 2025 Baseline.

Table 3-20 Vancouver Regional Air Pollutant Emissions

Scenario	Emissions (Metric Tons/day)					
	CO		HC		NO _x	
2025 Baseline	628		25		23	
2025 Highway Focus	641	+2.1%	25	-0.3%	24	+1.7%
2025 Pricing Focus	605	-3.7%	24	-5.0%	22	-3.9%
2025 Transit Focus	608	-3.1%	24	-4.1%	23	-3.3%

The Mixed-Mode alternatives are expected to have results between the Baseline and Focus Alternatives. The Mixed: Highway Emphasis Alternative is expected to have CO and NO_x emissions greater than the Transit Focus Alternative, but less than the Highway Focus. The Mixed Transit Emphasis, Transit Emphasis with Pricing, and Transit Emphasis with TDM will have the lowest emissions of any of the scenarios.

Noise

Noise impacts were analyzed based on changes in VMT compared to the 2025 Baseline Scenario. While this approach does not identify all areas that would experience transportation noise impacts, it identifies locations where traffic noise would noticeably increase as a result of a scenario. Noise impacts are primarily associated with highway improvements, although steel-wheeled transit vehicles would also produce some noise impacts.

The Highway Focus Scenario would have the most potential for creating noise impacts, caused for the most part by the additional new facilities (i.e., additional lanes) where traffic volumes increase noticeably. The Pricing Focus Scenario would also potentially result in noise impacts; in this case the impacts would be due to travel route shifting, an effect of value pricing influence on travel behavior. The potential noise impacts of this scenario would most likely be offset by improvements in noise levels at locations from where traffic would be shifted. Mixed scenarios emphasizing roadway improvements would also result in potential noise impacts, although not as extensive as the Highway Focus Scenario. Transit improvements involving steel-wheeled transit vehicles are anticipated to have moderate level of noise impacts.

Minority and Low-Income Populations

The focus of this analysis was to define minority and low-income populations, identify their locations, and discuss potential impacts associated with each of the scenarios. Procedures for analyzing potential impacts in the Vancouver and Portland region were developed in consultation with WSDOT, ODOT, Clark County, and RTC, and rely on data from the 2000 US Census as well as information supplied by ODOT from the I-5 Transportation and Trade Partnership Study.

Figure 3-40 and Figure 3-41 show the Highway Focus and Transit Focus impacts on census tracts with high concentrations of low-income and minority populations in Vancouver and Portland. Due to differences in GIS systems for each region, there are separate maps for Vancouver and Portland.

The Vancouver and Portland urban areas have areas of concern for low income and/or minority communities. They are adjacent to many of the improvements analyzed in the various alternatives. In general, highway improvements have more potential for direct impacts, while transit improvements have more potential for benefit. All of the strategies have the potential for indirect benefits, such as reduced travel times, and indirect impacts, such as fewer transportation options and increased transportation and housing costs, that would affect the entire study area, including minority and low-income populations.

More detailed analysis at the project level would be required to more precisely locate minority and low-income populations and determine impacts.

Offering more transportation options, particularly affordable and accessible options such as transit, tends to benefit low-income and disabled groups who cannot drive or do not own cars. The mixed scenarios that emphasize roadway improvements would also have the potential to result in impacts on low-income and minority populations, although not to the extent of the Highway Focus Scenario.

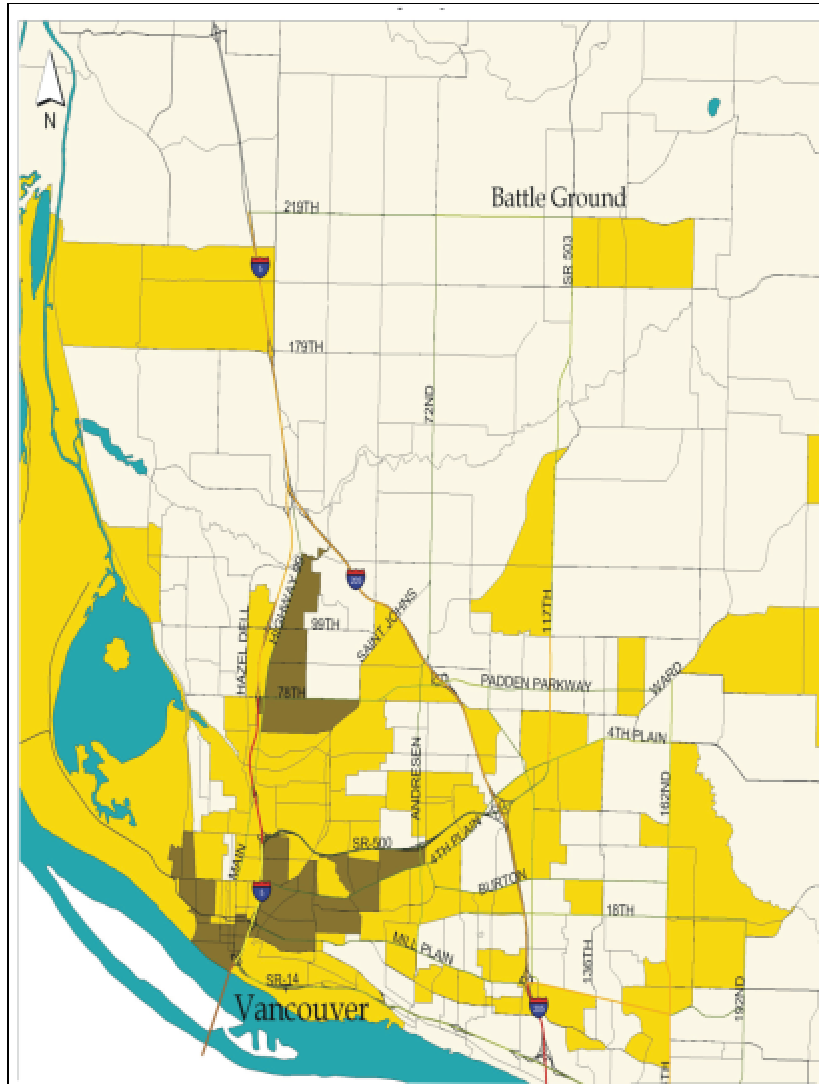
**Figure 3-40: Minority Population
Vancouver**



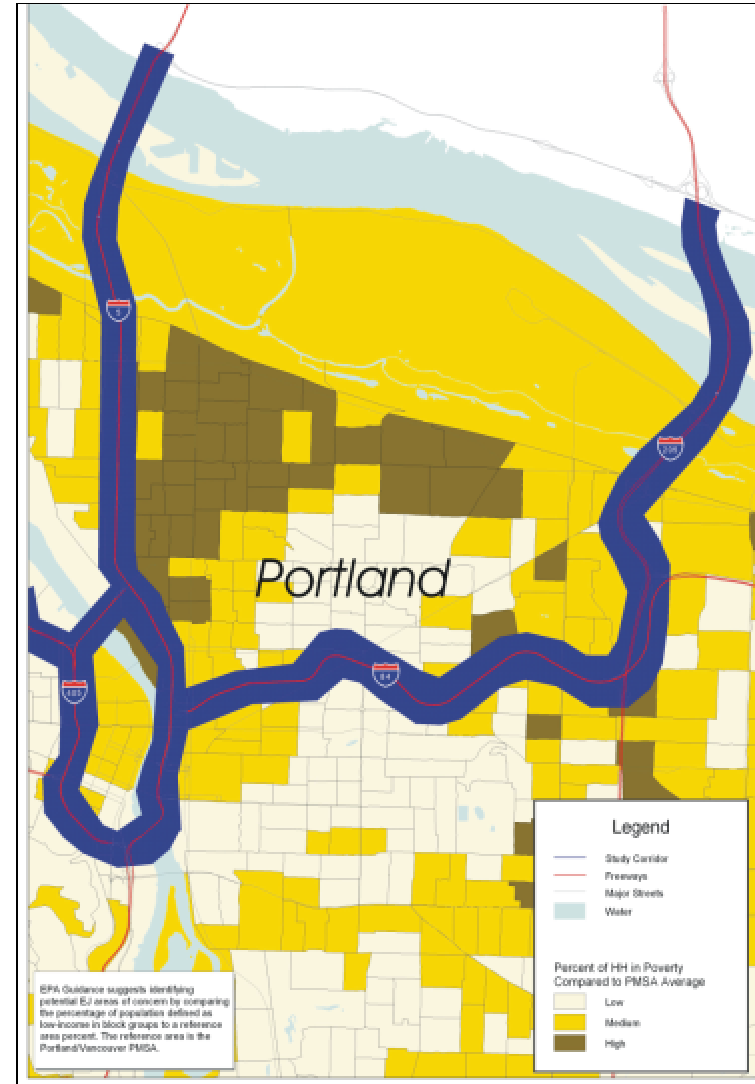
Portland



**Figure 3-41: Low-Income Population
Vancouver**



Portland



Access and Land Use

The interaction between land use and transportation is widely recognized; however, the relationship is complex. In March 2004, Metro—the Portland region’s Metropolitan Planning Organization—conducted a qualitative analysis of the potential land use impacts of the Highway Focus relative to the 2025 Baseline Scenario. This analyzed land use changes that would result from the highway improvements. The following is a summary of that analysis:

Region wide, average traffic analysis zone (TAZ) “access increase” would increase about 11%, ranging from 4 to 25% throughout the region. Compared to Metro’s experience in prior studies, this increase is considered significant.

The Clark County pattern would have moderate to significant increases in accessibility along the I-5 and I-205 Corridors within the present Urban Growth Management Area (UGA), and in areas north and east of the present UGA. The increases in the east county area around Camas and Washougal would be relatively small.

On the Oregon side, the analysis showed accessibility increases on the I-5 Corridor that would extend to the Tualatin area and also extend west on the US-26 Corridor into East Washington County. The pattern of access increase on the Oregon I-205 Corridor and east of the corridor would be less compared to the I-5 Corridor.

The changes to accessibility within the Vancouver region with the Highway Focus Scenario would likely result in pressure for changes to land use patterns in Clark County and in the Oregon portion of the region. Some of these land use changes could be beyond what is planned under the growth management plans. Areas where there is an increase of overall accessibility could also attract commercial, industrial, or residential developments.

3.10 Suggestions for Future Studies

Based on the results of this study, the Vancouver/Portland region should continue to explore cost effective options to relieve congestion. These options include:

- Strategic planning and investments to relieve bottlenecks.
- Further exploring targeted value pricing options where capacity and demand can better be balanced, and where multiple transportation modes are available to accommodate mode shift.
- Investigating targeted travel demand and system management strategies that show considerable promise in reducing delay with relatively low capital costs.